REGULATORY CERTIFICATION [IDAPA 58.01.01.123]

INTEGRATED WASTE TREATMENT UNIT PERMIT TO CONSTRUCT APPLICATION

The undersigned certifies as required per IDAPA 58.01.01.123 as follows:

Based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

Owner Signature

Elizabeth D. Sellers   Date: 8/14/06

Elizabeth D. Sellers, Manager
Department of Energy Idaho Operations Office

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Operator Signature

D. Brent Rankin ____________________ Date: 7/18/06

D. Brent Rankin, Vice President ESH&Q
CH2M WG, LLC.

Kenneth Hanna

From: Cheryl Robinson
Sent: Monday, September 18, 2006 1:47 PM
To: Kenneth Hanna; Brian English
Subject: FW: Clarification
Attachments: Clarification.doc

FYI...

Cheryl A. Robinson, P.E.
Air Quality Permitting Engineer
Idaho Department of Environmental Quality
1410 N. Hilton
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Phone: 208.373.0220 Fax: 208.373.0340
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From: Tkachyk, James W [mailto:James.Tkachyk@icp.doe.gov]
Sent: Monday, September 18, 2006 12:25 PM
To: Cheryl Robinson
Cc: Carvo, Alan E
Subject: Clarification

Attached is the clarification to some questions you had regarding the IWTU permit application. Call or e-mail Alan Carvo (208-526-1170) or myself (208-526-7965), if you have questions.

Cheryl,

Thanks for the heads up.

Added to your note to Ken below, I have included clarification regarding your questions below in red. The Criteria Pollutant Emissions included below your note to Ken should address the questions on the criteria pollutant annual emissions and the brief responses (all in red) below your request for clarification hopefully meet your needs. If I have missed something or more detailed information is required, please contact me (526-7965 or 526-7924) or Alan Carvo (526-1170) by phone or e-mail.

Ken,

Based on an initial review of the example MEB benchmarks from the Hazen pilot plant testing, SBW characterization, and TAPs worksheets submitted via e-mail from Alan Carvo and Jim Tkachyk on 8/31, as well as the application and EDF-6495, the emission inventory appears to be based on reasonable assumptions and calculations. Although the information is sufficient to justify a 15-day pre-permit construction approval, there are a few issues that will need to be addressed before the completeness determination for the EI can be finalized. Given the margin between the modeled ambient impacts using this EI, and the type of clarification needed, I would not expect that any changes to the EI that might result from resolving these items would cause problems demonstrating compliance with the NAAQS or TAPs increments.

1) Clarification regarding all criteria pollutant emissions estimates is required for annual as well as short-term emissions. In particular, clarification is needed with regard to how PM/PM_{10} was defined (e.g., won't some or most of the metal species that are also addressed as TAPs be emitted as particulates?). The short term (lb/hr) emissions of criteria pollutants in Table 8 were calculated by dividing the annual emissions in lb/year by 8760 hours/year. Please see the Criteria Pollutant Emissions calculations below.

The 15-day approval (with regard to the EI only) is based on the following:

a) The good correlation between the MEB-predicted CO and NOx emissions and the measured emissions for two test series at the Hazen facility.
b) The assertion by Scott Roesener during our August 25, 2006 meeting that configuration controls are in place for the MEB calculation package (i.e., the fundamental calculations used to estimate the emissions for this PTC application are the same as those used for the Hazen pilot project estimates).

2) Clarification regarding the filter efficiencies used in the EI. Sections 2.1.5 and 2.1.8 describe that the sintered metal filters are designed to remove >99.5% of particles larger than 2 microns. Section 4 (pg 7 of 15) of EDF-6495 notes that for Scenario 1 (used to estimate the annual emissions), the PM removal efficiency for the off-gas filter was increased from 99.5% to 99.9% based on changing from a baghouse to a sintered metal filter. However, the description for Scenarios 2-7 refers to PGF and OGF specifications of 99.5% for particles greater than 2 microns, but then goes on to say that removal efficiencies of 99.9% are expected. Removal efficiencies used to calculate emissions should not exceed the filter specifications. There has been no testing performed on the filters having the listed specifications in the PTC (i.e., ≥99.5%). Although CWI still anticipates an efficiency of ≥99.9%, acceptance testing of the facility would be the first available information on the performance of the specified filters, and agrees that the specified efficiency of ≥99.5% for particulates greater than 2 μm diameter is conservative and would result in uncontrolled emissions of ~0.2 ton/year, and should be used.

3) Clarification why tank WM-187 waste characteristics were used to estimate the concentrations expected for the predicted 10,000 gallons of newly generated liquid waste (NGLW). Based on the solids contents in Tank WM-187, it would conservatively estimate the particulate emissions and still be representative for the criteria pollutant emissions.

4) Clarification regarding the additional 40% of wastes reportedly added to the annual feed totals to account for additional wastes that might be treated. In Section 4 of the application (pg. 16), the maximum volume of waste is described as 883,000 of SBW in the tanks (which includes 5% from jet dilution) + 40% additional wastes = 1,236,000 gallons of waste. The TAPs worksheets submitted on 8/31, however, show a total amount of waste liquid feed as 883,354 gallons for Scenario 1 (the annual emissions), and ties that value to the estimated annual TAPs emissions for the carcinogens. You are correct. The transmitted tables were only intended to demonstrate the highest potential emission rates for comparison to the ELs and modeling of AACs for non-carcinogens. The TAP ELs were exceeded for the carcinogens, and therefore the annual averages were used for modeling the AACCs but were not calculated in the submitted tables. However, the annual emissions from the averages were calculated previously (including the 40% increase in volume) in the PTC Application using the example calculation methodology for arsenic as listed in the notes in Table 8 of the Application, and have not changed.

The annual Criteria Pollutant Emissions calculations below were increased by 40% prior to including them in Tables 4 and Table 8 of the PTC Application.

Criteria Pollutant Emissions

1. Emissions through the Process HEPA Filters

   a. Carbon monoxide (CO)
   Carbon monoxide is produced in the DMR as part of the steam reforming process by the following reaction.

   $C_{(s)} + H_2O_{(g)} \rightarrow CO_{(g)} + H_{2(g)}$

   Additional carbon monoxide can be produced in the bottom portion of the DMR where oxygen is added to react with the carbon to provide heat to the process.

   $C_{(s)} + \frac{1}{2} O_{(g)} \rightarrow CO_{(g)}$

   However, in the DMR a large percentage of the carbon monoxide will be reacted to carbon dioxide via the gas-shift reaction and by complete oxidation.

   $CO_{(g)} + H_2O_{(g)} \rightarrow CO_{2(g)} + H_{2(g)}$
   $CO_{(g)} + \frac{1}{2} O_{(g)} \rightarrow CO_{2(g)}$

   The mass and energy balance calculates how much carbon monoxide is created by determining the quantity of carbon and oxygen that is necessary to heat the DMR to 640°C and achieve 2 mol% hydrogen in the DMR emissions. Ten percent of the carbon fed to the DMR is assumed blow overhead unreacted to the process filter and one percent is assumed removed in the solid product unreacted. The steam reforming process converts nitrates in the waste feed to solid carbonate product thus consuming carbon. The remaining carbon is oxidized or steam reformed to carbon dioxide (assumed 97%) or carbon monoxide (assumed 3%). Carbon monoxide is passed from the DMR through the process filter to the CRR.

The CRR is operated at ~1000°C and oxygen is added to produce an oxidizing environment. In this environment virtually all carbon including carbon monoxide will be oxidized to carbon dioxide. The mass and energy balance assumes 3% of the carbon monoxide fed to the CRR will be left unreacted and pass through the CRR to the downstream offgas processes.

After the CRR it is assumed the no other unit operation will affect carbon monoxide and it will pass through to the stack.

b. Nitrogen Oxide Gas (NO_x)

Waste feed to the SBW process contains a high concentration of nitrate. The high temperature reducing environment of the DMR is designed to destroy the nitrates by reducing it to nitrogen gas. Based on engineering experience and pilot plant testing ~7% (conservatively) of the nitrate fed to the DMR will not be fully reduced in the DMR and will pass through the process filter to the CRR as NO_x gas (assumed as NO gas).

The lower portion of the CRR is operated such that it is a reducing environment. In this portion of the CRR the NO_x emissions from the DMR are further reduced to nitrogen. Based on engineering judgement it is assumed that 50% (conservatively) of the NO_x fed to the CRR will be reduced.

c. Sulfur Oxide (SO_2)

Based on studies performed at the Star center at INL, 1% of the sulfur fed to the DMR is expected to be carried with the offgas as SO_x. All of the SO_x in the DMR offgas then passes through the rest of the offgas system to the stack. The 99% of sulfur left in the DMR is split with the particulates.

Petroleum coke is added to the CRR to maintain 1000°C operation. Petroleum coke include a some sulfur content (assumed 0.8 wt%). All of this sulfur is assumed oxidized and to pass into the offgas as SO_2 and be passed to the stack.

d. Mecury

All mecury is assumed to pass with the offgas through the DMR, process filter, CRR, offgas filter, and HEPA Filters. The only unit operation to assumed to remove mecury is the carbon bed which removes 99.99% of the mercury.

e. Flourine

Based on studies performed at the Star Center at INL, 3% of the fluorine fed to the DMR is expected to be carried with the offgas as gaseous HF. All of the HF in the DMR offgas then passes through the rest of the offgas system to the stack. The 97% of flourine left in the DMR is split with the particulates in the DMR and the rest of the flowsheet.

f. Volitile Organic Carbon (VOC)

Organics enter the process primarily with the charcoal to the DMR and CRR. In the DMR which operates at ~640°C and is a reducing environment, the organics will volitalize. All organics except C_6H_6O and C_4H_4O are assumed to be reacted to methane.

The CRR operates at a nominal temperature of 1000°C and is an oxidizing environment. In this environment VOCs are highly reactive so all VOCs are assume destroyed.

g. Particulate components (e.g. lead):

SBW is fed to the DMR where 50% of the feed carry over that becomes particulate (non-gaseous) is blown over to the process filter. The process filter is a sintered metal filter that removes 99.5% of the solids based on design specifications. The remaining 0.5% of particulates is sent to the CRR where only a neglible amount of particulate is expected to be removed. The CRR offgas is sent through a cooler which removes nothing and then through the offgas filter (sintered metal) that removes 99.5% of the solids based on design specifications. The offgas is then passed through a set of filters including a prefilter and 2 HEPA filters. No credit is taken for the pre-filter removing solids. The HEPAs remove 99.97% of the solids based on DOE-STD-3020-97. The offgas is then passed through a carbon bed before exiting through the stack. No credit is taken for particulate removal in the carbon bed.

h. Total Particulates (PM_{10} is considered the same as total particulates):

Total particulates is the sum of all particulate components (including solid fluorine compounds) and the carbon fines that are carried with the offgas.

Included are all solids in the feed and the non-gaseous emissions described above.

2. Emissions through the Building HEPA Filters

   a. Particulates including lead:

      All solid particulates that are removed by the DMR, process filter, or offgas filter are sent to the product receiver for packaging. 1% of the product is assumed to entrain in the vacuum which is sent to the vacuum filter. The product receiver is assumed to remove a similar quantity of solids as the DMR (i.e. 50%). The product receiver offgas then passes through a receiver filter that removes 99.9% of the particulates. Following the receiver filter the offgas is sent to the vacuum filter with the 1% solids entrained from the product. The vacuum filter removes 99.9% of the particulates based on design specifications. The offgas then passes through a post filter that removes 95% of the particulates based on previous operating experience. The offgas is then passed through a set of building filters including a prefilter and 2 HEPA filters. No credit is taken for the pre-filter removing solids. The HEPAs remove 99.97% of the solids based on DOE-STD-3020-97.

Document ID: EDF-6495
Revision ID: 0
Effective Date: 05/30/06

Engineering Design File

Project No.

MASS AND ENERGY BALANCE FOR SODIUM BEARING WASTE INTEGRATED WASTE TREATMENT UNIT - MODIFIED TO SUPPORT EMISSIONS PERMITTING

Idaho Cleanup Project

The Idaho Cleanup Project is operated for the U.S. Department of Energy by CH2M • WG Idaho, LLC

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Elizabeth D. Sellers

Elizabeth D. Sellers, Manager
Department of Energy Idaho Operations Office

Date: 8/14/06

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D. Brent Rankin

D. Brent Rankin, Vice President ESH&Q
CH2M WG, LLC.

Date: 7/18/06

ENGINEERING DESIGN FILE

EDF No.: 6495 EDF Rev. No.: 0 Project File No.:

1. Title: MASS AND ENERGY BALANCE FOR SODIUM BEARING WASTE INTEGRATED WASTE TREATMENT UNIT - MODIFIED TO SUPPORT EMISSIONS PERMITTING

2. Index Codes:

   Building/Type N/A SSC ID N/A Site Area INTEC

3. NPH Performance Category: ______ or ☒ N/A

4. EDF Safety Category: ______ or ☒ N/A SCC Safety Category: ______ or ☒ N/A

5. Summary:

The reviewed and approved version of the THOR-48, Idaho Waste Treatment Unit (IWTU) Sodium Bearing Waste (SBW), Mass and Energy Balance (MEB) – Carbonate Flow Sheets, was modified to support emissions permitting. The modifications included addition of more current radionuclide and chemical compositions and a recalculation of radionuclide splits and process holdup. The pertinent results are summarized. The approved and modified versions of the MEB are attached as an electronic file.

6. Review (R) and Approval (A) and Acceptance (Ac) Signatures:
   (See instructions for definitions of terms and significance of signatures.)

	R/A	Typed Name/Organization	Signature	Date
Performer/ Author	N/A	J. A. Tadlock	John Tadlock	5/11/06
Technical Checker	R	W. S. Roesener	W. Scott Roesener	5/11/06
Independent Peer Reviewer (if applicable)	R	N/A		
Approver	A	W. H. Landman	W H Landman Jr	5/22/06
Requestor (if applicable)	Ac			
Reviewer	R	J.W. Tkachyk/INTEC Environmental Support	J. W. Tkachyk	5/25/06
Reviewer	R			
Doc. Control	Ac	Carly Anderson	Carly Anderson	5/30/06

7. Distribution: (Name and Mail Stop)

8. Does document contain sensitive unclassified information? ☐ Yes ☒ No
   If Yes, what category:

9. Can document be externally distributed? ☐ Yes ☒ No

10. Uniform File Code: 8201 Disposition Authority: A17-31-d
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11. For QA Records Classification Only: ☐ Lifetime ☐ Nonpermanent ☐ Permanent
    Item and activity to which the QA Record apply:

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12. NRC related? ☐ Yes ☒ No

EDF No.: 6429 EDF Rev. No.: 0 Project File No.: 25051

1. Title: MASS AND ENERGY BALANCE FOR SODIUM BEARING WASTE INTEGRATED WASTE TREATMENT UNIT - MODIFIED TO SUPPORT EMISSIONS PERMITTING

2. Index Codes:

Building/Type N/A SSC ID N/A Site Area INTEC

13. Registered Professional Engineer's Stamp (if required)

MASS AND ENERGY BALANCE FOR SODIUM BEARING WASTE INTEGRATED WASTE TREATMENT UNIT - MODIFIED TO SUPPORT EMISSIONS PERMITTING

1. INTRODUCTION

A mass and energy balance (MEB) has been developed that describes the Sodium Bearing Waste (SBW) steam reforming treatment process to be used in the Integrated Waste Treatment Unit (IWTU). A fully reviewed and approved version (28276-26-01, revision C) of the MEB was issued on August 3, 2005 in support of the Critical Decision phase two (CD-2) submittal. Subsequent to issue, additional information was added to the MEB to improve its fidelity. These changes to the MEB were initially made in EDF-6429 to support the Preliminary Documented Safety Analysis (PDSA). Specifically, the radiological source term was updated to include the latest estimates as found in, "*Generation, Disposition, and Current Inventory of Radionuclides in the INTEC Tank Farm,*" ICP/EXT-05-00928, dated June 2005. The chemical source term was also updated to reflect the latest estimates as found in, "*Confirmation Study of the SBW Characterization Data,*" Interoffice Memorandum from C. B. Millet to W. S. Roesener, dated July 11, 2005 (MIL-05-05). These updates were placed on the SBW Feed worksheet of the MEB. In addition, the SBW Feed worksheet was updated to allow easy input of scenarios (e.g. Tank 187 liquid and solid waste, Tank 188 and 189 blended liquid waste, etc.). This change allowed better estimation of chemical additives and schedules by allowing the ratio of feeds from different tanks to be easily varied. Finally, the Source Term worksheet was updated to provide more accurate estimates of radionuclide splits with solids in the DMR and to update holdup calculations in vessels. Changes to the MEB are described in more detail as items 29-32 on the "Change Tracker" worksheet of the attached MEB scenario run.

The changes made to the reviewed and approved MEB revision C (28276-26-001) were reviewed and verified for correctness. Electronic copies of the updated MEB for the seven operating scenarios used in this EDF, as well as electronic copies of MEB revision C and its supporting review and approval documentation is attached to this EDF. The signature on this EDF by the technical checker of the updated MEB constitutes verification and acceptance of the updates.

2. PURPOSE

The purpose of this analysis is to conservatively estimate the emissions from the IWTU for significance determination per IDAPA 58.01.01 section 006.89 as well as peak toxic air pollutant emission rates for comparison to emissions levels (EL) and acceptable ambient concentrations/acceptable ambient carcinogenic concentration (AAC/AACC) per IDAPA 58.01.01 sections 585 and 586. Emission estimates from this report will not be directly compared to the AAC/AACC but will be used in dispersion modeling which will provide the results to be compared to the AAC/AACC. Input to the MEB as modified to support the PDSA was modified to develop scenarios for a conservative annual average flow rate from the IWTU as well as peak flows.

Also, conservative annual emission rates for radionuclides are estimated. The radionuclide estimates will be used in dose calculations that will be compared to regulatory limits.

3. REFERENCES

28276-26-001, Rev. C, "*Mass and Energy Balance – Carbonate Flow Sheets*," THOR Treatment Technologies, August 3, 2005.

28276-21-050, Rev. A, "*Product Receiver, Product Handling Vacuum, and Product Handling Post Filters COSs*", THOR Treatment Technologies, January 6, 2006.

COS-F-SRH-0141 A/B, Rev. A, "*Equipment Data Sheets – Mercury Adsorbers,*" April 6, 2006

DOE-STD-3020-97, "*Specification for HEPA Filters Used By DOE Contractors,*" January 1997.

EDF-6429, Rev. 1, "*Mass and Energy Balance for Sodium Bearing Waste Integrated Waste Treatment Unit- Modified to Support Preliminary Documented Safety Analysis Report*", April 13, 2006.

ICP/EXT-05-00928, Rev. 0, "*Generation, Dispostion, and Current Inventory of Radionuclides in the INTEC Tank Farm,*" June 2005.

IDAPA 58.01.01, "*Rules for the Control of Air Pollution in Idaho,*" Department of Environmental Quality.

INEEL/EXT-2000-01378, Rev. 4, "*Feed Composition for the Sodium Bearing Waste Treatment Process*" June 2004.

INEL/EXT-04-01493, Rev. 0, "*Phase 2 THOR Steam Reforming Tests for Sodium Bearing Waste Treatment,*" January 2004.

MIL-05-05, Interoffice Memorandum from C. B. Millet to W. S. Roesener, "*Confirmation Study of the SBW Characterization Data,*" dated July 11, 2005.

RT-ESTD-002, Rev. 0, "*Pilot Plant Test Preliminary Completion Report for Treating Sodium-Bearing Waste Surrogates Using the THOR®Steam Reforming Process – Carbonate Flowsheet,*" THOR Treatment Technologies, February 28, 2006.

Specification 15533, Rev. 1, "*Process Gas Filter,*" THOR Treatment Technology, April 12, 2006.

Specification 15535, Rev. A, "SBW Off-Gas Filter," THOR Treatment Technology, April 12, 2006.

4. SCENARIOS

Seven scenarios were run through the modified MEB for this analysis. The first scenario is used to conservatively estimate the annual emissions from the IWTU. Scenarios 2-7 reduced efficiencies of filters and ran different feeds through the plant to represent the operational feeds that are expected through the plant. The following scenario inputs were changed from the PDSA version of the MEB for all 7 scenarios.

- The waste is fed to the DMR at the maximum of 3.5 gpm to maximize the emissions rate.
- The mercury concentration was increased by 25% to increase it to the high end of the analytical uncertainty as reported in *"Feed Composition for the Sodium Bearing Waste Treatment Process"*, INEEL/EXT-2000-01378.
- To add conservatism to emissions the particulate carry-over from the Denitration/Mineralization Reformer (DMR) was increased from 30% (expected carry-over) to 50% (worst case carry-over seen during testing at the STAR center as reported in *"Phase 2 THOR Steam Reforming Tests for Sodium Bearing Waste Treatment"*, INEL/EXT-04-01493).
- Additionally, the high efficiency particulate air (HEPA) filters efficiency was increased to 99.97% to match the DOE standard for HEPA Filters (*"Specification for HEPA Filters Used By DOE Contractors"*, DOE-STD-3020-97).
- For conservatism, no credit was taken for solids removal through the HEPA pre-filter (i.e. the removal efficiency of the pre-filter was set to 0).
- The mercury removal efficiency was reduced from 99.999% to 99.99% based on the minimum required removal efficiency per the mercury adsorber equipment data sheets *"Equipment Data Sheets – Mercury Adsorbers"* (COS-F-SRH-0141).
- The NO_x carry-over in the DMR was increased from 3% to 7% to conservatively reflect data from pilot plant testing data (RT-ESTD-002).
- The NO_x carry-over in the Carbon Reduction Reformer (CRR) was increased from 10% to 50% to reflect data from pilot plant testing data (RT-ESTD-002).
- For conservatism, no credit was taken for I-129 that may adsorb on the carbon in the CRR offgas after the cooler. The MEB revision C took removed 5% of the I-129 with the solids in the offgas cooler (OGC).
- To more accurately reflect to carbon monoxide emissions from the IWTU as seen in the pilot plant test data (RT-ESTD-002) the carbon dioxide to carbon monoxide ratio in the offgas of the DMR was increased from 92% to 97%. Additionally, the CO carry-over of carbon monoxide from the CRR was increased from 0.1% to 3%.
- The IWTU holds the option for addition of an autoclave system for processing of drummed waste. However, that system has been put on hold and will not be included in the permit. Therefore, all flows from the autoclave system to the IWTU ventilation system have been set to zero.

The feeds for each of the run scenarios are shown in Table 1.

<u>Scenario 1</u>
The following changes to the MEB input were made for scenario 1 to add conservatism to the expected annual emissions or to reflect design changes that have been made to the IWTU process since MEB revision C (28276-26-01) was issued. Changes to the MEB input for this scenario are described in more detail as items 33-45 on the "Change Tracker" worksheet of the attached MEB scenario 1 run.

- This analysis used the average composition of all tanks was used since all waste is scheduled to be processed within one year. An additional 10,000 gallons of waste with the liquid composition of WM-187 was added to represent processing of newly generated liquid waste (NGLW) through the IWTU.

- The particulate removal efficiency from the offgas filter (OGF) was increased from 99.5% to 99.9%. The increased removal efficiency is based on the change of the filter from a bag-house filter to a sintered metal filter.

Scenario 2-7
Scenarios 2-7 are used to conservatively estimate maximum short term emission rates for non-carcinogenic toxic emissions. Table 1 shows the feed for each scenario. Also, the following changes were made to the MEB revision C input to add conservatism for determination of a peak emission rate.

- The particulate removal efficiency from the process gas filter (PGF), OGF, product receiver filter, and product receiver vacuum filter were each decreased from 99.9% (99.5% for the OGF) to 99% for conservatism. Each of the product receiver filter and product receiver vacuum filter is specified for greater than 99.9% removal of particles greater than 1 micron (28276-21-050). The both the PGF (Specification 15533) and the OGF (Specification 15535) are specified for 99.5% or greater removal of particles greater than 2 micron. It is expected that each of the filters will remove greater than 99.9% of product fines from their respective gas streams.
- The fluorine and chlorine carry-overs from the DMR were tripled to 9% and 3% respectively for conservatism.
- For conservatism credit was taken for only 1 HEPA filter removing solid particulate.

5. RESULTS

Electronic copies of the MEB run for each of the seven scenarios for this EDF are included included on the attached CD. Worksheet "Stream Summaries" of the MEB contains the chemical composition of each stream through the IWTU. Worksheet "SBW Source Term" of the MEB contains the radionuclide composition of each stream containing radionuclides through the IWTU. Of particular interest for this analysis are the abated emissions to the stack (stream 84), and the unabated emissions to the process (stream 80) and building (stream 76) ventilation HEPA filters. Important results for emissions are included in this EDF as Tables 2 through 5. The emissions estimates were compared to Idaho Department of Environmental Quality screening criteria to determine significant emissions increase and toxic air pollutant levels.

Significant Emission Increase (IDAPA 58.01.01 section 006.89)
The Idaho Department of Environmental Quality sets net annual emission increases of certain pollutants that if exceeded set the pollutant as "significant" for the new facility (i.e. the IWTU). The potential "significant" pollutants expected in the emissions to from the IWTU are shown in Table 2. These values are conservative average emission rates for processing of all tank waste. The results do not reflect instantaneous or maximum short term emissions and should only be used for purposes of determining annual emissions. Some potential "significant" pollutants including sulfuric acid mist, hydrogen sulfide, reduced sulfur, or municipal waste emissions are not expected from the IWTU and are therefore not included in Table 2.

The annual emissions are based on scenario 1 representing the total waste to the IWTU. The total emissions are calculated by multiplying the abated (Stream 84) and unabated (Stream 76 plus 80) flowrate of the pollutant times the hours to process all of the waste through the IWTU (Cell C12 of the Feed-Product Summary Worksheet). An additional 40% is added to each annual emission to conservatively estimate other wastes that may be processed through the IWTU such as start-up testing surrogate, decon solution, or other newly generated waste NGLW.

All pollutants are below the "significant" level per IDAPA 58.01.01 section 006.89.

Carcinogenic and Non-Carcinogenic Toxic Air Emissions (IDAPA 58.01.01 sections 585 and 586)
The Idaho Department of Environmental Quality sets screening levels for toxic air pollutants on an incremental basis. This EDF specifically addresses the emissions levels for the screening emissions levels (EL). Several comparisons to the EL were done for this EDF.

The first EL comparison is an initial screening to see if it is even possible for the IWTU to exceed the EL. This was done with a waste feed rate of 3.5 gpm and assuming that 100% of the pollutants that enter the IWTU are emitted through the stack. All of the pollutants of concern for the IWTU are expected to be incorporated into the solid product and therefore the majority of the pollutants are not expected to be emitted from the stack. The results of this screening are given in Table 3. Silver, barium, bromine, molybdenum, rhodium, selenium, tin, and zinc are shown to not even have the possibility of exceeding their EL. Of the remaining pollutants only cadmium, mercury, and possibly nickel are expected not to pass acceptable ambient concentrations/acceptable ambient carcinogenic concentration (AAC/AACC) screening after dispersion modeling is completed.

The second EL comparison is a conservative estimate for maximum short term unabated emissions from the process (i.e. off-gas from the off-gas filter (OGF) and from the product receiver post filter). Results for the unabated emissions are given in Table 4. Only arsenic, beryllium, cadmium, and mercury exceed the EL. No credit was taken for incorporation of arsenic or beryllium in the solid product or removal by abatement equipment (i.e. HEPA filters or mercury adsorber). It is expected that arsenic and beryllium will be incorporated into the solid product but data is limited so no credit is taken for removal of these pollutants for conservatism. Only mercury is expected to not pass AAC/AACC after dispersion modeling for the unabated case and therefore only mercury is expected to require taking credit for abatement.

The final EL comparison is a conservative estimate for the instantaneous abated emissions (i.e. stack emissions). Results for the abated emissions are given in Table 5. Only arsenic and beryllium are shown to exceed the EL in the abated emissions. Once again, no credit was taken for incorporation of arsenic or beryllium in the solid product or removal by abatement equipment. It is expected that arsenic and beryllium will be incorporated into the solid product but data is limited so no credit is taken for removal of these pollutants for conservatism. No pollutants are expected to fail AAC/AACC screening for the abated emissions.

Dispersion modeling will be done using this data to determine if any of the pollutants that exceed their EL will also exceed their AAC/AACC screening levels. It is important to note that for non-carcinogens the AAC is based on a 24 hour average so the worst case emissions rates as reported in Tables 3-5 should be used. However, the AACC for carcinogens is based on an annual average so using the average feed case (scenario 1), multiplied by the operating time to process the waste (4,206 hours), divided by the hours per year (8760 hours), and increased by 40% to account for additional waste that may be processed during a year (e.g. start-up surrogates) is appropriate.

Radionuclide Emissions
The potential radionuclides expected in the emissions to from the IWTU are shown in Table 6. These values are conservative average emission rates for processing of all tank waste. The results do not reflect

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instantaneous or maximum short term emissions and should only be used for purposes of determining annual emissions.

The annual emissions are based on scenario 1 representing the total waste to the IWTU. The total emissions is calculated by adding the abated (Stream 84) and unabated (Stream 76 plus 80) flowrate of the pollutant times the hours to process all of the waste through the IWTU (Cell C12 of the Feed-Product Summary Worksheet). An additional 40% is added to each annual emission to conservatively estimate other wastes that may be processed through the IWTU such as additional newly generated waste NGLW.

Based on previous dose calculations the radionuclide of most concern in emissions is iodine-129 (I-129). The I-129 reported in ICP/EXT-05-00928 is based on computer modeling of the amount of I-129 initially in the fuel sent to INTEC to be reprocessed. The I-129 is reduced by the amount that would have been processed through the calciner. No credit has been taken for removal of I-129 that would have been lost due to evaporation during any of the evaporator campaigns that have been run on liquid waste over INTEC's history. Additionally, the SBW MEB takes no credit for I-129 that would be removed during processing through the IWTU process primarily by the sulfur impregnated granulated carbon (S-GAC) beds. The I-129 emissions reported in this report are conservative.

6. CONCLUSION

Seven scenario runs were made on a modified version of MEB revision C to conservatively estimate emissions in support permitting of the IWTU. Tables 2-5 show the data important for emissions permitting. Emissions estimates were compared to screening criteria as set by the Idaho Department of Environmental Quality (IDAPA 58.01.01) for significant pollutant increase and toxic air pollutant emission levels.

No pollutant exceeds the significant level as stated in IDAPA 58.01.01 section 006.89. Nitrogen oxide (NOx) and Sulfur Dioxide (SO_2) are the closest to the set significance level for emission with 62.5% and 10% of the significance level respectively. Table 2 shows the comparison of pollutants to their significance level.

Three comparisons were done for toxic pollutant emission levels as stated in IDAPA 58.01.01 sections 585 and 586. These three comparisons were done to determine which pollutants require taking credit for removal in process equipment, which pollutants require taking credit for abatement equipment, and which pollutants require additional scrutiny for emissions permitting. Dispersion modeling is required to be completed for the toxic air pollutants to compare to the IDAPA 58.01.01 AAC/AACC. This EDF only compares emissions to the IDAPA 58.01.01 EL. Aluminum, arsenic, beryllium, cadmium, chlorine, chromium, fluorine, mercury, nickel, and calcium oxide would all exceed their EL if no credit is taken for reduction of emissions due to process or abatement equipment. Of these elements only cadmium, mercury, and nickel are expected to exceed their AAC/AACC once dispersion modeling is completed. Therefore, only cadmium and possibly nickel are expected to require taking credit for removal by the process equipment. Only mercury is expected to require taking credit for abatement equipment.

Conservative annual radionuclide emissions are provided. The radionuclide emissions will be used in future calculations for dose.

Table 1 Scenario Feeds

Scenario	Operating Scenario	IWTU Feed Composition
1	Process average composition of all tanks. This case is used to estimate the annual emissions.	262,600 gallons liquid from WM-187 281,800 gallons liquid from WM-188 281,700 gallons liquid from WM-189 105,100 kg solids from WM-187 5,000 kg solids from WM-188 5,000 kg solids from WM-189 42,064 gallons of water (5% jet dilution)
2	Processing the majority of WM-187 solids with part of the WM187 liquid	143,000 gallons liquid from WM-187 98,500 kg solids from WM-187 7150 gallons of water (5% jet dilution)
3	Process remaining liquid in WM-187	110,000 gallons of liquid from WM-187 5,500 gallons of water (5% jet dilution)
4	Process WM-188	281,800 gallons liquid from WM-188 5,000 kg solids from WM-188 14,123 gallons of water (5% jet dilution)
5	Process WM-189	281,700 gallons liquid from WM-189 5,000 kg solids from WM-189 14,118 gallons of water (5% jet dilution)
6	Wash and process remaining heel liquid from WM-187, WM-188, and WM-189	8,260 gallons liquid from WM-187 8,260 gallons liquid from WM-188 8,260 gallons liquid from WM-189 37,379 gallons water (rinse water)
7	Processing tank rinse liquor to remove remaining solids from WM-187, WM-188, and WM-189	1,334 gallons liquid WM-187 1,334 gallons liquid WM-188 1,334 gallons liquid WM-189 659 kg solids from WM-187 500 kg solids from WM-188 500 kg solids from WM-189 25,582 gallons water (rinse water)

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Table 2 Emissions of Non-radioactive Potentially "Significant" Pollutants

	Significant Level (IDAPA 58.01.01)	Unabated Emissions	Abated Emissions
	Tons/year	Tons/year	Tons/year
Carbon Monoxide	100	1.44	1.44
Nitrogen Oxides	40	31.77	31.77
Sulfur Dioxide	40	5.20	5.20
Particulate Matter	25	0.04	3.37E-09
Ozone (VOC)	40	0.00E+00	0.00E+00
Lead	0.6	1.15E-06	1.04E-13
Flourides	3	0.06	0.06

*Note: Flowrates reported represent conservative average flowrates for emissions. These flowrates do not represent worst case instantaneous or maximum short term flows.

Table 3 Maximum short term Emissions of Carcinogenic and Non-Carcinogenic Toxic Air Pollutants if 100% of Waste Feed is Emitted from Stack

	Emission Limit	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr
Ag	0.001	4.04E-04	6.95E-06	7.59E-06	7.76E-04	4.20E-04	1.68E-04	6.20E-05
Al	0.133	2.90E+01	2.09E+01	2.28E+01	3.31E+01	3.20E+01	1.23E+01	4.53E+00
As	1.5E-6	3.16E-04	1.79E-07	1.95E-07	4.41E-07	9.42E-04	1.32E-04	4.86E-05
Ba	0.033	1.16E-02	2.15E-03	2.35E-03	1.95E-02	1.29E-02	4.85E-03	1.79E-03
Be	2.8E-5	2.02E-04	3.40E-10	3.71E-10	3.00E-04	3.03E-04	8.43E-05	3.11E-05
Br_2	0.047	4.29E-05	2.47E-05	2.70E-05	6.10E-05	4.18E-05	1.81E-05	6.69E-06
Cd	3.7E-6	5.04E-01	1.31E-01	1.43E-01	6.37E-01	7.32E-01	2.11E-01	7.79E-02
Cl_2[(a)]	0.2	1.57E+00	1.41E+00	1.54E+00	2.05E+00	1.21E+00	6.70E-01	2.47E-01
HCl[(b)]	0.05	1.62E+00	1.45E+00	1.58E+00	2.11E+00	1.25E+00	6.89E-01	2.54E-01
Cr	0.033	4.17E-01	2.45E-01	2.67E-01	5.06E-01	4.88E-01	1.76E-01	6.50E-02
F	0.167	7.21E-01	1.09E+00	1.19E+00	6.09E-01	4.35E-01	3.11E-01	1.15E-01
Hg	0.003	2.21E+00	6.21E-01	6.78E-01	3.23E+00	2.71E+00	9.25E-01	3.41E-01
Mo	0.333	3.25E-02	3.82E-03	4.17E-03	4.81E-02	4.48E-02	1.36E-02	5.00E-03
Ni	2.7E-5	2.02E-01	1.37E-01	1.49E-01	2.36E-01	2.27E-01	8.56E-02	3.15E-02
Rh	0.001	6.53E-04	3.76E-04	4.11E-04	9.28E-04	6.36E-04	2.76E-04	1.02E-04
Se	0.013	1.11E-04	6.42E-05	7.00E-05	1.58E-04	1.08E-04	4.70E-05	1.73E-05
Sn	0.133	9.19E-03	8.57E-03	9.35E-03	1.05E-02	8.18E-03	3.92E-03	1.44E-03
Zn	0.667	7.75E-02	1.21E-09	1.32E-09	1.15E-01	1.16E-01	3.23E-02	1.19E-02
CaO[(c)]	0.667	5.70E+00	3.54E+00	3.86E+00	6.58E+00	6.82E+00	2.41E+00	8.89E-01

Notes:

Gray cells indicate an emission that exceeds the Toxic Air Pollutants screening emissions level. Many of these are not expected to be a problem following modeling to determine the ambient concentration to compare to the acceptable ambient concentrations per IDAPA 58.01.01.

a) All chlorine in the emissions assumed as Cl_2.
b) All chlorine in the emissions assumed as HCl.
c) All calcium expected in the offgas was assumed as CaO.

Table 4 Conservative Unabated Maximum Short Term Emissions of Carcinogenic and Non-Carcinogenic Toxic Air Pollutants (IDAPA 58.01.01)

	Emission Limit	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr
Ag[(a)]	0.001	4.04E-04	6.95E-06	7.59E-06	7.76E-04	4.20E-04	1.68E-04	6.20E-05
Al	0.133	5.76E-05	5.29E-04	3.75E-03	4.49E-03	5.06E-03	1.86E-03	1.03E-03
As[(a)]	1.5E-6	3.16E-04	1.79E-07	1.95E-07	4.41E-07	9.42E-04	1.32E-04	4.86E-05
Ba[(a)]	0.033	1.16E-02	2.15E-03	2.35E-03	1.95E-02	1.29E-02	4.85E-03	1.79E-03
Be[(a)]	2.8E-5	2.02E-04	3.40E-10	3.71E-10	3.00E-04	3.03E-04	8.43E-05	3.11E-05
Br_2[(a)]	0.047	4.29E-05	2.47E-05	2.70E-05	6.10E-05	4.18E-05	1.81E-05	6.69E-06
Cd[(b)]	3.7E-6	5.17E-07	1.64E-06	8.24E-06	3.66E-05	4.21E-05	1.22E-05	4.48E-06
Cl_2[(c)]	0.2	1.57E-02	4.22E-02	4.61E-02	6.14E-02	3.64E-02	2.01E-02	7.41E-03
HCl[(d)]	0.05	1.62E-02	4.34E-02	4.74E-02	6.32E-02	3.75E-02	2.07E-02	7.62E-03
Cr	0.033	3.57E-07	2.55E-06	1.28E-05	2.43E-05	2.34E-05	8.46E-06	3.12E-06
F	0.167	2.16E-02	9.78E-02	1.07E-01	5.48E-02	3.92E-02	2.80E-02	1.03E-02
Hg	0.003	2.21E+00	6.21E-01	6.78E-01	3.23E+00	2.71E+00	9.25E-01	3.41E-01
Mo[(a)]	0.333	3.25E-02	3.82E-03	4.17E-03	4.81E-02	4.48E-02	1.36E-02	5.00E-03
Ni	2.7E-5	1.04E-07	8.55E-07	4.29E-06	6.80E-06	6.52E-06	2.46E-06	9.07E-07
Rh[(a)]	0.001	6.53E-04	3.76E-04	4.11E-04	9.28E-04	6.36E-04	2.76E-04	1.02E-04
Se[(a)]	0.013	1.11E-04	6.42E-05	7.00E-05	1.58E-04	1.08E-04	4.70E-05	1.73E-05
Sn[(a)]	0.133	9.19E-03	8.57E-03	9.35E-03	1.05E-02	8.18E-03	3.92E-03	1.44E-03
Zn	0.667	7.95E-08	1.51E-14	7.56E-14	6.59E-06	6.69E-06	1.86E-06	6.84E-07
CaO[(e)]	0.667	2.63E-05	2.79E-04	1.33E-03	1.56E-03	1.59E-03	1.17E-03	1.50E-03

Notes:

Gray cells indicate an emission that exceeds the Toxic Air Pollutants screening emissions level. These will most likely not be a problem following modeling to determine the ambient concentration to compare to the acceptable ambient concentrations per IDAPA 58.01.01.

a) For conservatism 100% of the toxic fed to the IWTU was assumed to exit with the off-gas. This is extremely conservative since the majority of these toxics is expected to be incorporated into the solid product to be disposed at WIPP.
b) Cadmium was assumed to have the same splits as Zinc.
c) All chlorine in the emissions assumed as Cl_2.
d) All chlorine in the emissions assumed as HCl.
e) All calcium expected in the offgas was assumed as CaO.

Table 5 Conservative Maximum Short Term Abated Emissions of Non-Carcinogenetic and CarcinogenicToxic Air Pollutants (IDAPA 58.01.01)

	Emission Limit	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr
Ag[(a)]	0.001	4.04E-04	6.95E-06	7.59E-06	7.76E-04	4.20E-04	1.68E-04	6.20E-05
Al	0.133	5.18E-12	1.59E-07	1.12E-06	1.35E-06	1.52E-06	5.59E-07	3.09E-07
As[(a)]	1.5E-6	3.16E-04	1.79E-07	1.95E-07	4.41E-07	9.42E-04	1.32E-04	4.86E-05
Ba[(a)]	0.033	1.16E-02	2.15E-03	2.35E-03	1.95E-02	1.29E-02	4.85E-03	1.79E-03
Be[(a)]	2.8E-5	2.02E-04	3.40E-10	3.71E-10	3.00E-04	3.03E-04	8.43E-05	3.11E-05
Br_2[(a)]	0.047	4.29E-05	2.47E-05	2.70E-05	6.10E-05	4.18E-05	1.81E-05	6.69E-06
Cd[(b)]	3.7E-6	1.55E-10	4.92E-10	2.47E-09	1.10E-08	1.26E-08	3.65E-09	1.34E-09
Cl_2[(c)]	0.2	1.57E-02	4.22E-02	4.61E-02	6.14E-02	3.64E-02	2.01E-02	7.41E-03
HCl[(d)]	0.05	1.62E-02	4.34E-02	4.74E-02	6.32E-02	3.74E-02	2.07E-02	7.62E-03
Cr	0.033	3.21E-14	7.66E-10	3.84E-09	7.29E-09	7.02E-09	2.54E-09	9.35E-10
F	0.167	2.16E-02	9.78E-02	1.07E-01	5.48E-02	3.91E-02	2.80E-02	1.03E-02
Hg	0.003	2.21E-04	6.21E-05	6.78E-05	3.23E-04	2.71E-04	9.25E-05	3.41E-05
Mo[(a)]	0.333	3.25E-02	3.82E-03	4.17E-03	4.81E-02	4.48E-02	1.36E-02	5.00E-03
Ni	2.7E-5	9.32E-15	2.57E-10	1.29E-09	2.04E-09	1.95E-09	7.38E-10	2.72E-10
Rh[(a)]	0.001	6.53E-04	3.76E-04	4.11E-04	9.28E-04	6.36E-04	2.76E-04	1.02E-04
Se[(a)]	0.013	1.11E-04	6.42E-05	7.00E-05	1.58E-04	1.08E-04	4.70E-05	1.73E-05
Sn[(a)]	0.133	9.19E-03	8.57E-03	9.35E-03	1.05E-02	8.18E-03	3.92E-03	1.44E-03
Zn	0.667	7.15E-15	4.52E-18	2.27E-17	1.98E-09	2.01E-09	5.57E-10	2.05E-10
CaO[(e)]	0.667	2.37E-12	8.38E-08	3.98E-07	4.69E-07	4.76E-07	3.50E-07	4.49E-07

Notes:

Gray cells indicate an emission that exceeds the Toxic Air Pollutants screening emissions level. These will most likely not be a problem following modeling to determine the ambient concentration to compare to the acceptable ambient concentrations per IDAPA 58.01.01.

a) For conservatism 100% of the toxic fed to the IWTU was assumed to exit with the off-gas. This is extremely conservative since the majority of these toxics is expected to be incorporated into the solid product to be disposed at WIPP.
b) Cadmium was assumed to have the same splits as Zinc.
c) All chlorine in the emissions was assumed as Cl_2.
d) All chlorine in the emissions was assumed as HCl.
e) All calcium expected in the offgas was assumed as CaO.

Table 6 Radionuclide Annual Emissions

	Feed	DMR/Filter Emission	CRR/Filter Emissions (Unabated Emission)	Product Reciever Emissions (Unabated Emission)	IWTU Stack Emissions (Abated Emission)
	Ci/year	Ci/year	Ci/year	Ci/year	Ci/year
Am-241	3.18E+02	1.58E-01	1.58E-04	1.67E-04	2.92E-11
Am-242	1.61E-01	7.95E-05	7.95E-08	8.43E-08	1.47E-14
Am-243	2.21E-01	1.10E-04	1.10E-07	1.16E-07	2.03E-14
Ba-137m	2.13E+05	1.05E+02	1.05E-01	1.12E-01	1.95E-08
C-14	6.57E-04	6.57E-04	6.57E-04	0.00E+00	6.57E-04
Cm-242	1.91E-01	9.47E-05	9.47E-08	1.00E-07	1.76E-14
Cm-243	2.89E-02	1.43E-05	1.43E-08	1.52E-08	2.66E-15
Cm-244	2.82E+00	1.40E-03	1.40E-06	1.48E-06	2.59E-13
Cm-245	3.78E-04	1.87E-07	1.87E-10	1.98E-10	3.47E-17
Cm-246	2.48E-05	1.23E-08	1.23E-11	1.30E-11	2.28E-18
Co-60	4.95E+01	2.45E-02	2.45E-05	2.60E-05	4.55E-12
Cs-137	2.25E+05	1.11E+02	1.11E-01	1.18E-01	2.07E-08
H-3	3.62E+01	3.62E+01	3.62E+01	0.00E+00	3.62E+01
I-129	1.32E-01	1.32E-01	1.32E-01	0.00E+00	1.32E-01
Ni-63	2.75E+02	1.36E-01	1.36E-04	1.44E-04	2.53E-11
Np-237	3.00E+00	1.49E-03	1.49E-06	1.58E-06	2.76E-13
Pu-236	1.47E-03	7.27E-07	7.27E-10	7.71E-10	1.35E-16
Pu-238	4.98E+03	2.47E+00	2.47E-03	2.62E-03	4.58E-10
Pu-239	7.63E+02	3.78E-01	3.78E-04	4.01E-04	7.01E-11
Pu-240	1.36E+02	6.75E-02	6.75E-05	7.16E-05	1.25E-11
Pu-241	1.97E+03	9.75E-01	9.75E-04	1.03E-03	1.81E-10
Pu-242	9.97E-02	4.94E-05	4.94E-08	5.23E-08	9.15E-15
Se-79	2.41E+00	1.20E-03	1.20E-06	1.27E-06	2.22E-13
Sn-126	2.27E+00	1.13E-03	1.13E-06	1.19E-06	2.09E-13
Sr-90	1.51E+05	7.47E+01	7.47E-02	7.92E-02	1.39E-08
Tc-99	1.10E+02	5.43E-02	5.43E-05	5.76E-05	1.01E-11
U-233	3.99E-04	1.98E-07	1.98E-10	2.10E-10	3.67E-17
U-235	3.27E-01	1.62E-04	1.62E-07	1.72E-07	3.00E-14
U-238	1.87E-01	9.27E-05	9.27E-08	9.82E-08	1.72E-14
Y-90	1.51E+05	7.47E+01	7.47E-02	7.92E-02	1.39E-08

ICP/EXT-05-01116
Project No. 25051

Integrated Waste Treatment Unit – Application for Permit to Construct

P-060520

Permit No.: T1-060521

Facility ID No.: 023-00001

PID: SSBG-PTCS/SSTV.V022

Logged: ✓

August 2006

Idaho Cleanup Project
Idaho Falls, Idaho 83415

Prepared for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14516

CONTENTS

FIGURES

TABLES

ACRONYMS

AAC	Acceptable Ambient Concentration
ASME	American Society of Mechanical Engineers
BSB	Big Southern Butte
CAM	compliance assurance monitoring
CFR	Code of Federal Regulations
CRR	Carbon Reduction Reformer
CWI	CH2M-WG Idaho, LLC
DEQ	(Idaho) Department of Environmental Quality
DMR	Denitration and Mineralization Reformer
DOE	U.S. Department of Energy
DOE-HQ	U.S. Department of Energy Headquarters
DOE-ID	U.S. Department of Energy Idaho Operations Office
EDE	effective dose equivalent
GAC	granular activated carbon
HAP	hazardous air pollutant
HEPA	high-efficiency particulate air
HVAC	heating, ventilating, and air conditioning
HWY	Highway
ICP	Idaho Cleanup Project
IDAPA	Idaho Administrative Procedures Act
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IWTU	Integrated Waste Treatment Unit
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants

NGLW	newly generated liquid waste
NWCF	New Waste Calcining Facility
PM	particulate matter
PSD	prevention of significant deterioration
PTC	Permit to Construct
PW	process weight
SBW	sodium bearing waste
TAP	toxic air pollutant
TFF	Tank Farm Facility
tpy	tons per year
VOC	volatile organic compound

Integrated Waste Treatment Unit – Application for Permit to Construct

1. INTRODUCTION

CH2M-WG Idaho, LLC (CWI) and the U.S. Department of Energy Idaho Operations Office (DOE-ID), are requesting a 15-Day Pre-Permit Construction and Permit to Construct (PTC) approval in accordance with the Idaho Administrative Procedures Act (IDAPA), Rules for the Control of Air Pollution in Idaho, 58.01.01.213 for the installation of a new liquid waste treatment unit. This unit, called the Integrated Waste Treatment Unit (IWTU), is designed to treat sodium-bearing waste (SBW) and newly generated liquid waste (NGLW) to produce a solid treatment product for ultimate disposal. The Idaho National Laboratory (INL) is eligible for this 15-Day Permit Construction Approval as the IWTU permit application is:

- Not a major new source or a major modification,
- Not utilizing offsets, and
- Includes a comprehensive air quality assessment (attached), as well as other pre-construction approval administrative requirements.

In addition, DOE-ID is requesting that the Idaho National Laboratory Site, Tier I Operating Permit T1-030520 be changed as an Administrative amendment. Under IDAPA 58.01.01.381.01.e, the amendment is to incorporate into the Tier I Operating Permit, requirements from a PTC issued by the Idaho Department of Environmental Quality (DEQ) in accordance with Subsection 209.05.c.

The IWTU will be located on the INL Site. The INL Site is an existing major source located in south-east Idaho. This large tract of federally owned land covers approximately 890 square miles and is described in further detail in this report. A project meeting was held via conference call with DEQ staff on May 3, 2006, and an ambient air modeling discussion on May 15, 2006, which satisfies IDAPA 58.01.01.213.01b. A public informational meeting has been scheduled for August 28, 2006. The public meeting notice was published in the Idaho Falls Post Register on August 10, 2006. A copy of this notice is included in Appendix A and satisfies IDAPA 58.01.01.213.01c.

An application fee of $1,000 is attached to this application as required by IDAPA 58.01.01.226.

In addition, permit application forms have been prepared for each emission generating unit (Appendix B) including a responsible official signature as required by IDAPA 58.01.01.123.

1.1 Background

From 1952 to 1991, the Department of Energy (DOE) (and predecessor agencies) processed spent nuclear fuel at the Idaho Nuclear Technology and Engineering Center (INTEC). The process was designed to recover the highly enriched uranium in the fuel using a three-step solvent extraction process. The first solvent extraction cycle resulted in a highly radioactive liquid that was stored at the INTEC Tank Farm Facility (TFF) and processed through a calciner to produce a solid waste stored in bins at INTEC. Subsequent extraction cycles, as well as decontamination activities, generated liquid waste that was concentrated by evaporation and stored at the TFF. Because of the high sodium content from decontamination activities, this waste has been referred to as SBW. In addition, NGLW from similar processes and decontamination activities at the INTEC have also been evaporated and stored at the TFF. Approximately 900,000 gallons of SBW are stored in underground, stainless-steel tanks.

The Idaho Cleanup Project (ICP), administered by the DOE-ID, is responsible to manage, store, treat, and dispose the remaining SBW and NGLW currently stored at the INTEC. In accordance with the requirements of DOE Order 413.3, Critical Decision-0, *Mission Need for Sodium Bearing Waste*, was approved by DOE/EM-1 January 3, 2005, providing the justification for treatment of SBW to a final waste form. Closure of the INTEC TFF and treatment of the SBW by December 31, 2012, are key elements of the *Environmental Management Performance Management Plan for Accelerating Cleanup of the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2002). The steam reforming process utilized by the IWTU was selected as the preferred technology to treat liquid SBW.

The purpose of this application is to meet State of Idaho air permitting requirements, set forth in IDAPA 58.01.01.200-225, for the IWTU facility. All projected air emissions are discussed in a later section of this document.

1.2 Project Location

The proposed IWTU Project is located on the INL Site, which is a restricted-access, government-owned facility that covers over 2,305 square kilometers (890 square miles) in south-eastern Idaho. The INL Site is on the Snake River Plain having an average elevation of approximately 1,520 meters (5,000 feet) above sea level (Figure 1).

The IWTU (CPP-1696) will be located in the northeastern quadrant of INTEC on the INL Site (Figure 2). The facility consists of four interconnected areas including the: (1) Storage Building, (2) Material Unloading, (3) Process Area, and (4) Heating, Ventilating, and Air Conditioning (HVAC) Area, which house the SBW steam reforming processes and controls. The complete facility is approximately 380 feet long (north-south) by 198 feet wide (east-west) (Figures 3 and 4). The ridge height of the process building is 75 feet. Emissions from the facility are exhausted through a single 120-foot-high stack on the southwest corner of the building, CPP-1696.

2. INTEGRATED WASTE TREATMENT UNIT PROCESS

2.1 Process Overview

Approximately 900,000 gallons of mixed liquid waste, containing both hazardous and radioactive components, are stored in three 300,000 gallon tanks at the INTEC TFF. This waste is collectively known as SBW. A steam reforming process was selected to treat this waste. The specific steam reforming technology incorporated into the IWTU is a dual fluidized-bed process that uses superheated steam, carbon, and other additives to convert the SBW into a solid, granular treatment product that is packaged into canisters suitable for ultimate disposal. The process is named the IWTU because two fluidized-bed steam reformers are integrated into a single treatment process with a common air pollution control system.

2.1.1 CPP-1696 Integrated Waste Treatment Unit

The IWTU utilizes dual fluidized-bed steam reformers to convert liquid waste to a solid granular treatment product. The IWTU also utilizes five storage tanks: one to manage liquid feed and IWTU process solutions, three tanks (Product Receiver/Coolers) to cool and collect solid treatment product prior to loading it into canisters for storage and ultimate disposal, and one tank to collect fire water in the event of IWTU ventilation treatment system upset conditions. Two container storage areas are associated with the IWTU to allow storage of the canisters in portable concrete vaults.

Process flow diagrams for the IWTU are included in Figures 5, 6, and 7.

Integrated Waste Treatment Unit – Application for Permit to Construct

1. INTRODUCTION

CH2M-WG Idaho, LLC (CWI) and the U.S. Department of Energy Idaho Operations Office (DOE-ID), are requesting a 15-Day Pre-Permit Construction and Permit to Construct (PTC) approval in accordance with the Idaho Administrative Procedures Act (IDAPA), Rules for the Control of Air Pollution in Idaho, 58.01.01.213 for the installation of a new liquid waste treatment unit. This unit, called the Integrated Waste Treatment Unit (IWTU), is designed to treat sodium-bearing waste (SBW) and newly generated liquid waste (NGLW) to produce a solid treatment product for ultimate disposal. The Idaho National Laboratory (INL) is eligible for this 15-Day Permit Construction Approval as the IWTU permit application is:

- Not a major new source or a major modification,
- Not utilizing offsets, and
- Includes a comprehensive air quality assessment (attached), as well as other pre-construction approval administrative requirements.

In addition, DOE-ID is requesting that the Idaho National Laboratory Site, Tier I Operating Permit T1-030520 be changed as an Administrative amendment. Under IDAPA 58.01.01.381.01.e, the amendment is to incorporate into the Tier I Operating Permit, requirements from a PTC issued by the Idaho Department of Environmental Quality (DEQ) in accordance with Subsection 209.05.c.

The IWTU will be located on the INL Site. The INL Site is an existing major source located in south-east Idaho. This large tract of federally owned land covers approximately 890 square miles and is described in further detail in this report. A project meeting was held via conference call with DEQ staff on May 3, 2006, and an ambient air modeling discussion on May 15, 2006, which satisfies IDAPA 58.01.01.213.01b. A public informational meeting has been scheduled for August 28, 2006. The public meeting notice was published in the Idaho Falls Post Register on August 10, 2006. A copy of this notice is included in Appendix A and satisfies IDAPA 58.01.01.213.01c.

An application fee of $1,000 is attached to this application as required by IDAPA 58.01.01.226.

In addition, permit application forms have been prepared for each emission generating unit (Appendix B) including a responsible official signature as required by IDAPA 58.01.01.123.

1.1 Background

From 1952 to 1991, the Department of Energy (DOE) (and predecessor agencies) processed spent nuclear fuel at the Idaho Nuclear Technology and Engineering Center (INTEC). The process was designed to recover the highly enriched uranium in the fuel using a three-step solvent extraction process. The first solvent extraction cycle resulted in a highly radioactive liquid that was stored at the INTEC Tank Farm Facility (TFF) and processed through a calciner to produce a solid waste stored in bins at INTEC. Subsequent extraction cycles, as well as decontamination activities, generated liquid waste that was concentrated by evaporation and stored at the TFF. Because of the high sodium content from decontamination activities, this waste has been referred to as SBW. In addition, NGLW from similar processes and decontamination activities at the INTEC have also been evaporated and stored at the TFF. Approximately 900,000 gallons of SBW are stored in underground, stainless-steel tanks.

The Idaho Cleanup Project (ICP), administered by the DOE-ID, is responsible to manage, store, treat, and dispose the remaining SBW and NGLW currently stored at the INTEC. In accordance with the requirements of DOE Order 413.3, Critical Decision-0, *Mission Need for Sodium Bearing Waste*, was approved by DOE/EM-1 January 3, 2005, providing the justification for treatment of SBW to a final waste form. Closure of the INTEC TFF and treatment of the SBW by December 31, 2012, are key elements of the *Environmental Management Performance Management Plan for Accelerating Cleanup of the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2002). The steam reforming process utilized by the IWTU was selected as the preferred technology to treat liquid SBW.

The purpose of this application is to meet State of Idaho air permitting requirements, set forth in IDAPA 58.01.01.200-225, for the IWTU facility. All projected air emissions are discussed in a later section of this document.

1.2 Project Location

The proposed IWTU Project is located on the INL Site, which is a restricted-access, government-owned facility that covers over 2,305 square kilometers (890 square miles) in south-eastern Idaho. The INL Site is on the Snake River Plain having an average elevation of approximately 1,520 meters (5,000 feet) above sea level (Figure 1).

The IWTU (CPP-1696) will be located in the northeastern quadrant of INTEC on the INL Site (Figure 2). The facility consists of four interconnected areas including the: (1) Storage Building, (2) Material Unloading, (3) Process Area, and (4) Heating, Ventilating, and Air Conditioning (HVAC) Area, which house the SBW steam reforming processes and controls. The complete facility is approximately 380 feet long (north-south) by 198 feet wide (east-west) (Figures 3 and 4). The ridge height of the process building is 75 feet. Emissions from the facility are exhausted through a single 120-foot-high stack on the southwest corner of the building, CPP-1696.

2. INTEGRATED WASTE TREATMENT UNIT PROCESS

2.1 Process Overview

Approximately 900,000 gallons of mixed liquid waste, containing both hazardous and radioactive components, are stored in three 300,000 gallon tanks at the INTEC TFF. This waste is collectively known as SBW. A steam reforming process was selected to treat this waste. The specific steam reforming technology incorporated into the IWTU is a dual fluidized-bed process that uses superheated steam, carbon, and other additives to convert the SBW into a solid, granular treatment product that is packaged into canisters suitable for ultimate disposal. The process is named the IWTU because two fluidized-bed steam reformers are integrated into a single treatment process with a common air pollution control system.

2.1.1 CPP-1696 Integrated Waste Treatment Unit

The IWTU utilizes dual fluidized-bed steam reformers to convert liquid waste to a solid granular treatment product. The IWTU also utilizes five storage tanks: one to manage liquid feed and IWTU process solutions, three tanks (Product Receiver/Coolers) to cool and collect solid treatment product prior to loading it into canisters for storage and ultimate disposal, and one tank to collect fire water in the event of IWTU ventilation treatment system upset conditions. Two container storage areas are associated with the IWTU to allow storage of the canisters in portable concrete vaults.

Process flow diagrams for the IWTU are included in Figures 5, 6, and 7.

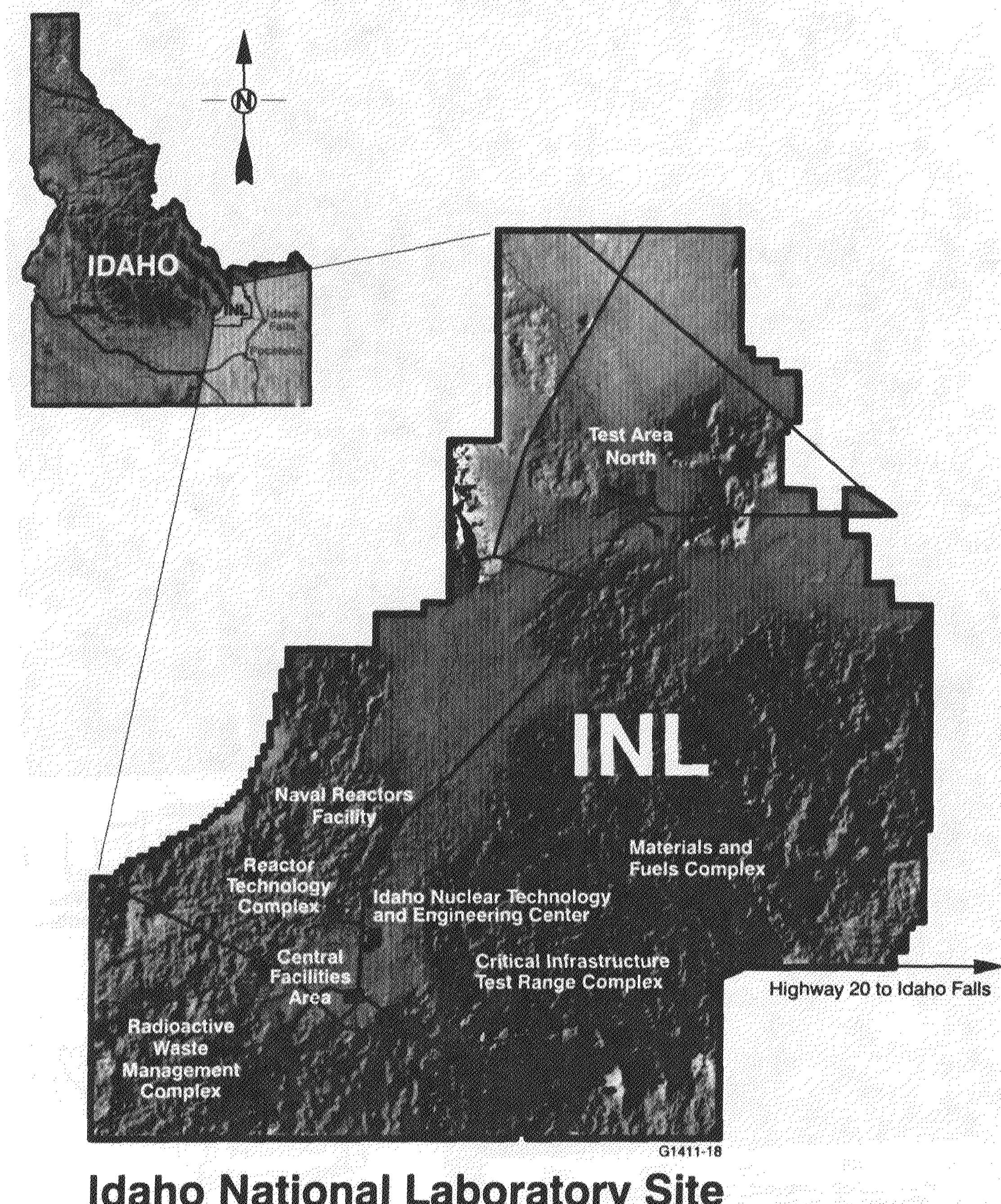

Figure 1. Idaho National Laboratory Site.

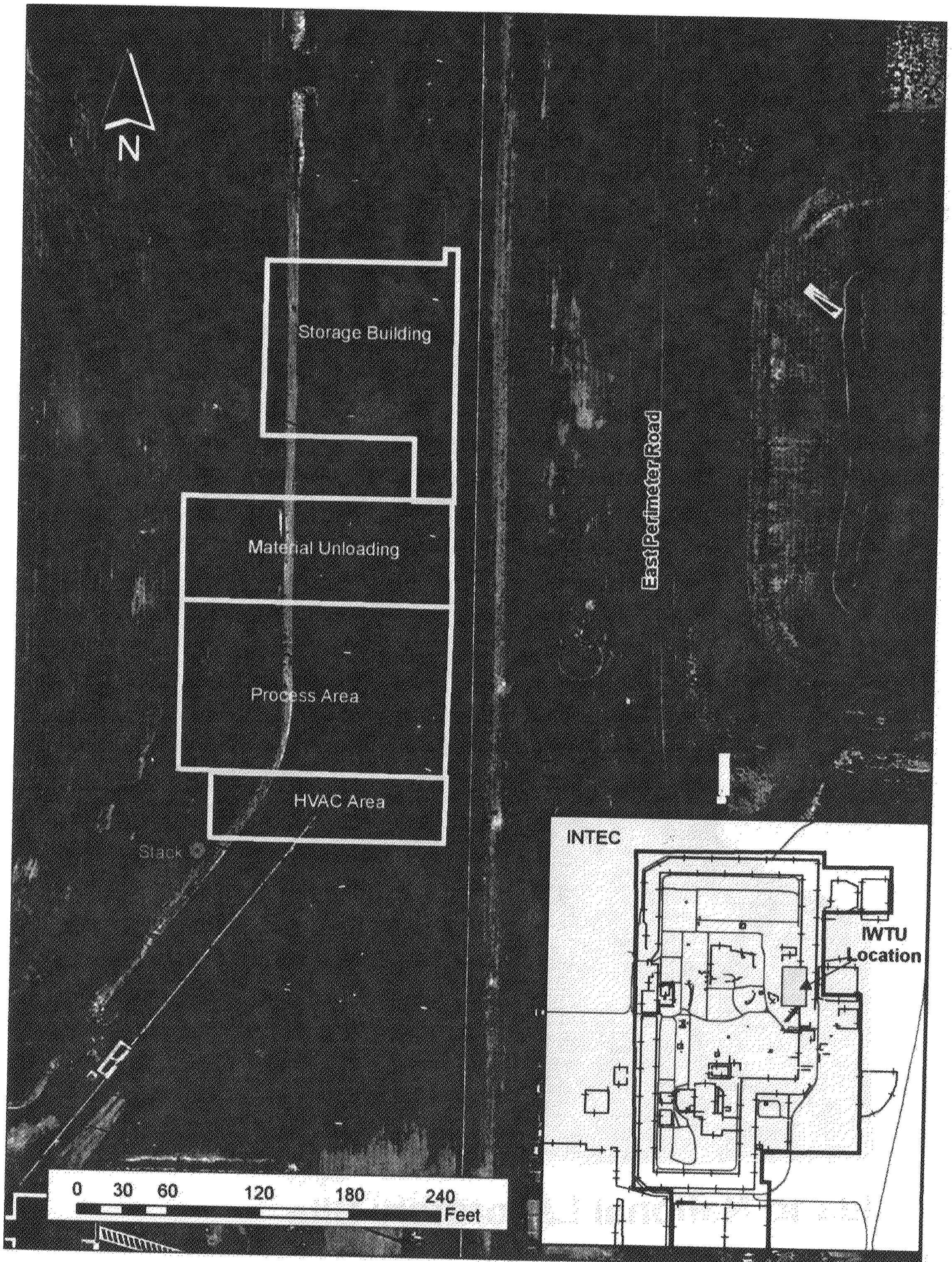

Figure 2. Integrated Waste Treatment Unit location at the Idaho Nuclear Technology and Engineering Center.

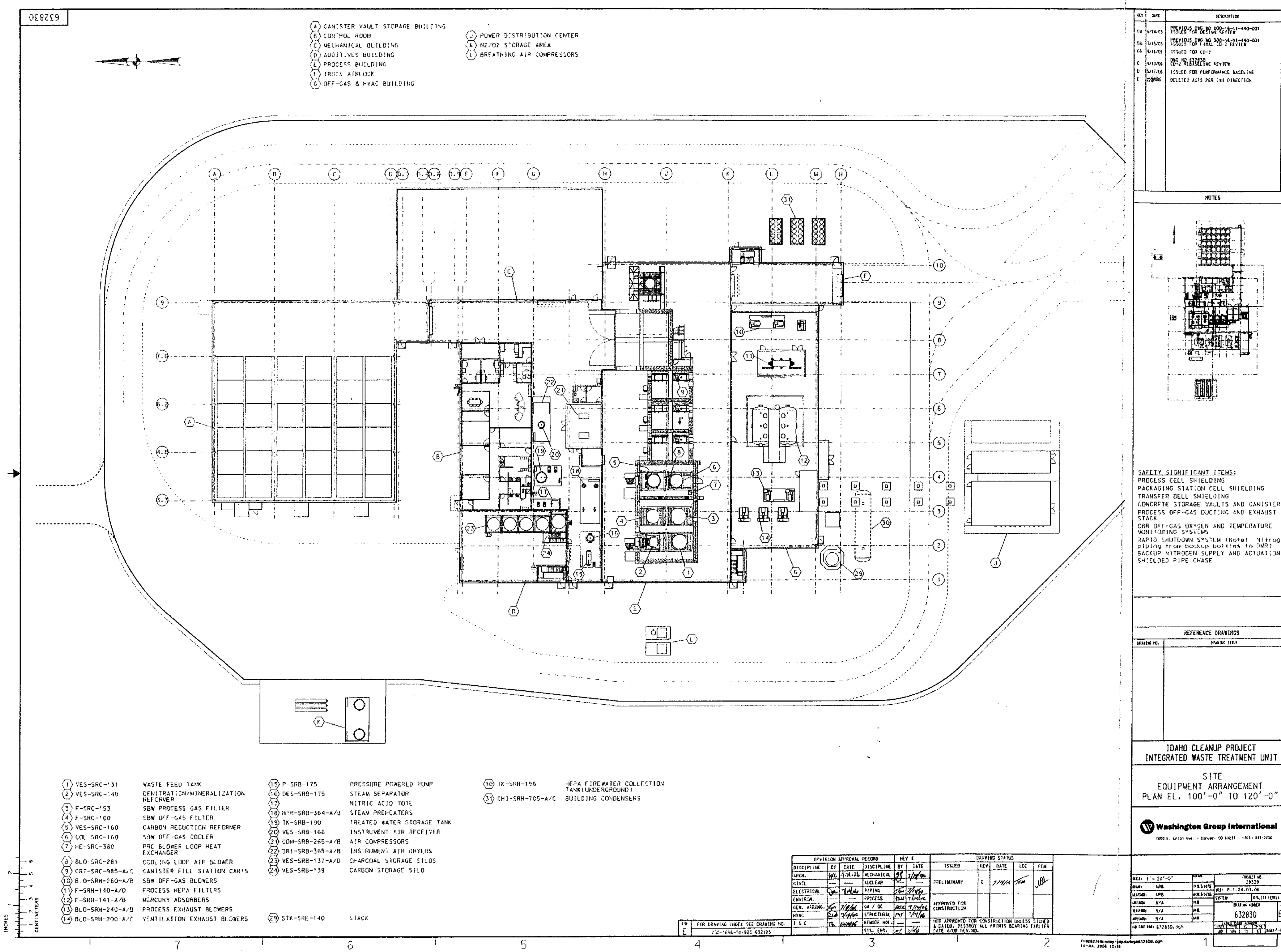

Figure 3. Site equipment arrangement (plan elevation 100 to 120 ft).

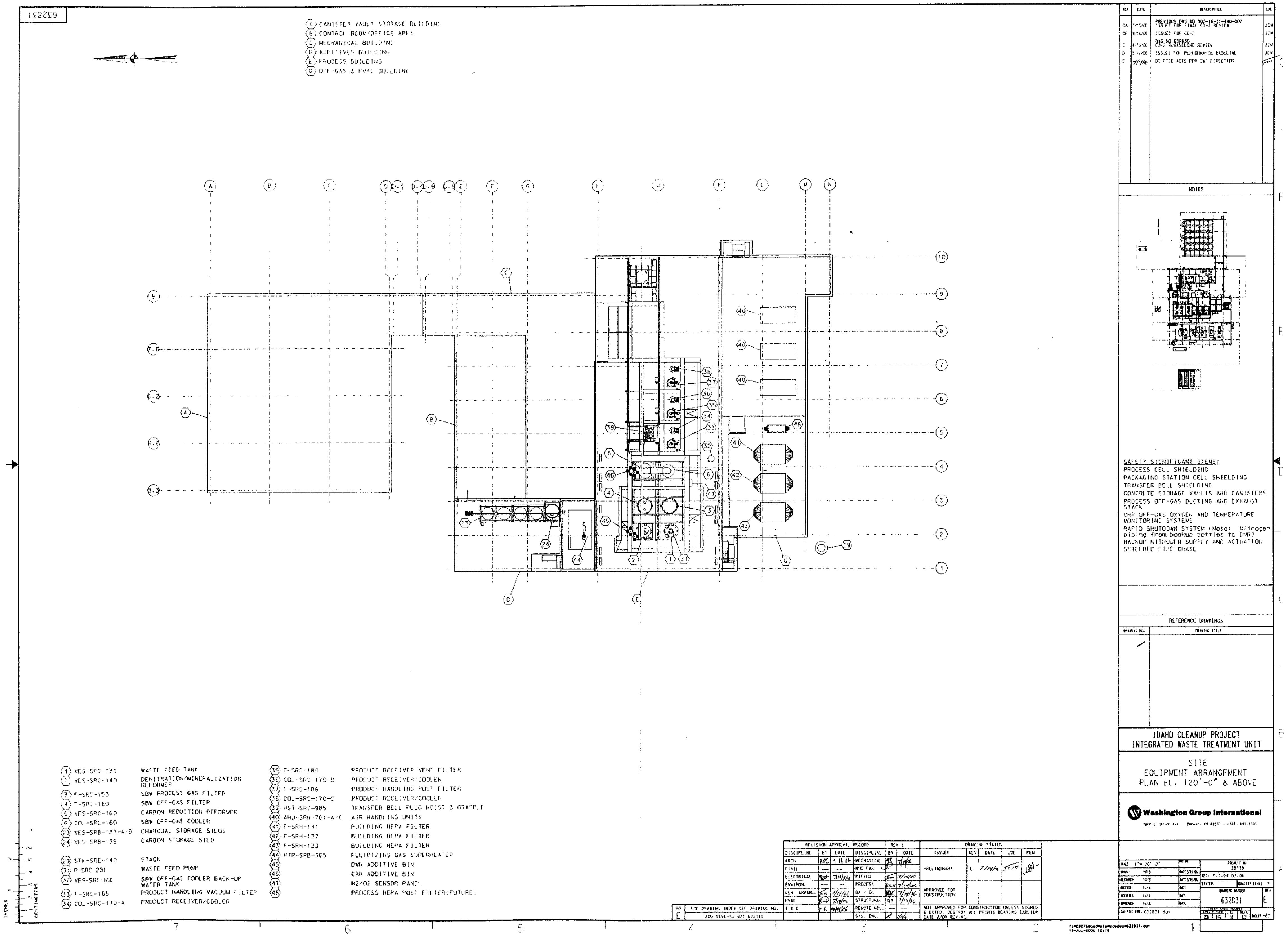

Figure 4. Site equipment arrangement (plan elevation 120 ft and above).

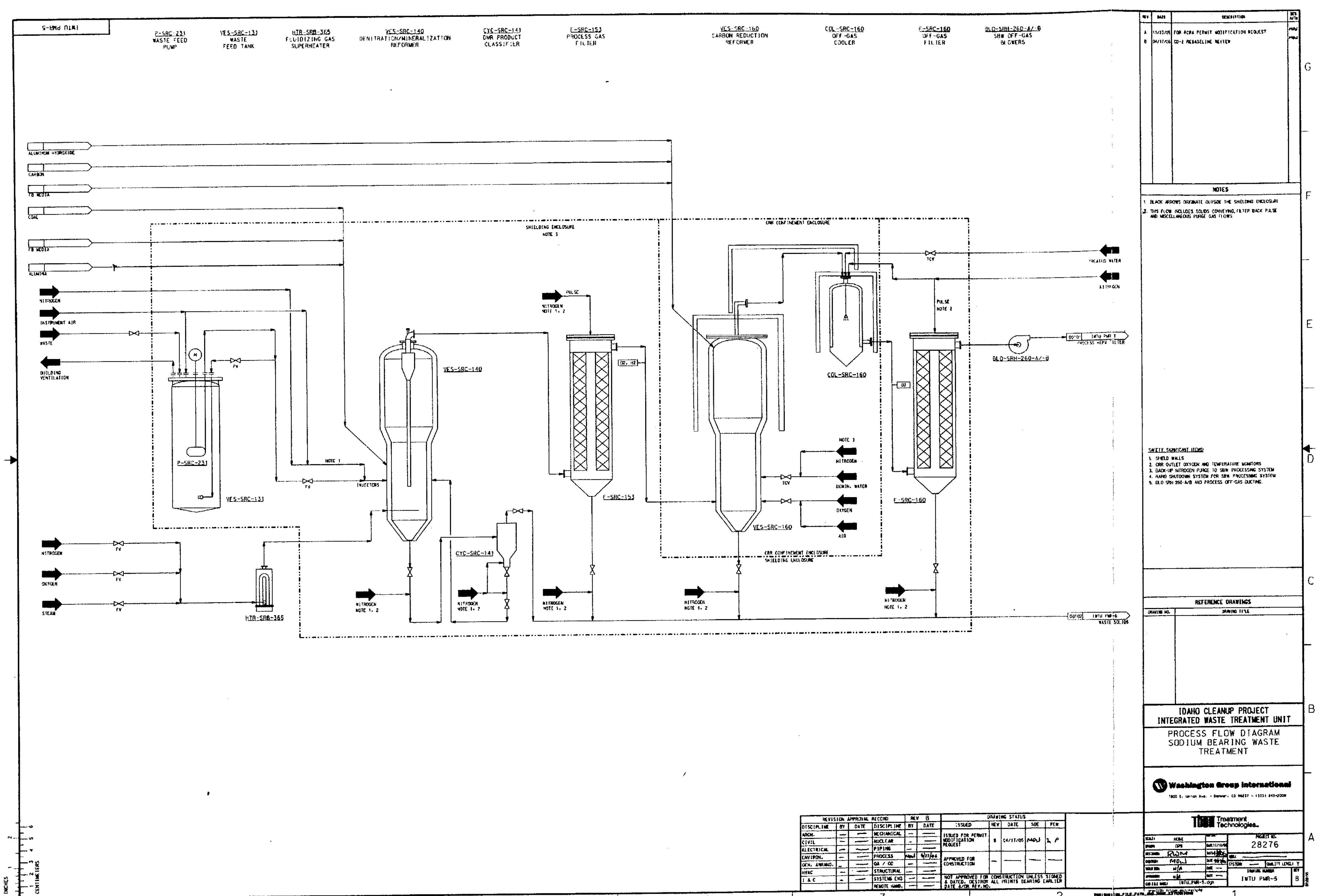

Figure 5. Process Flow Design – Sodium Bearing Waste Treatment.

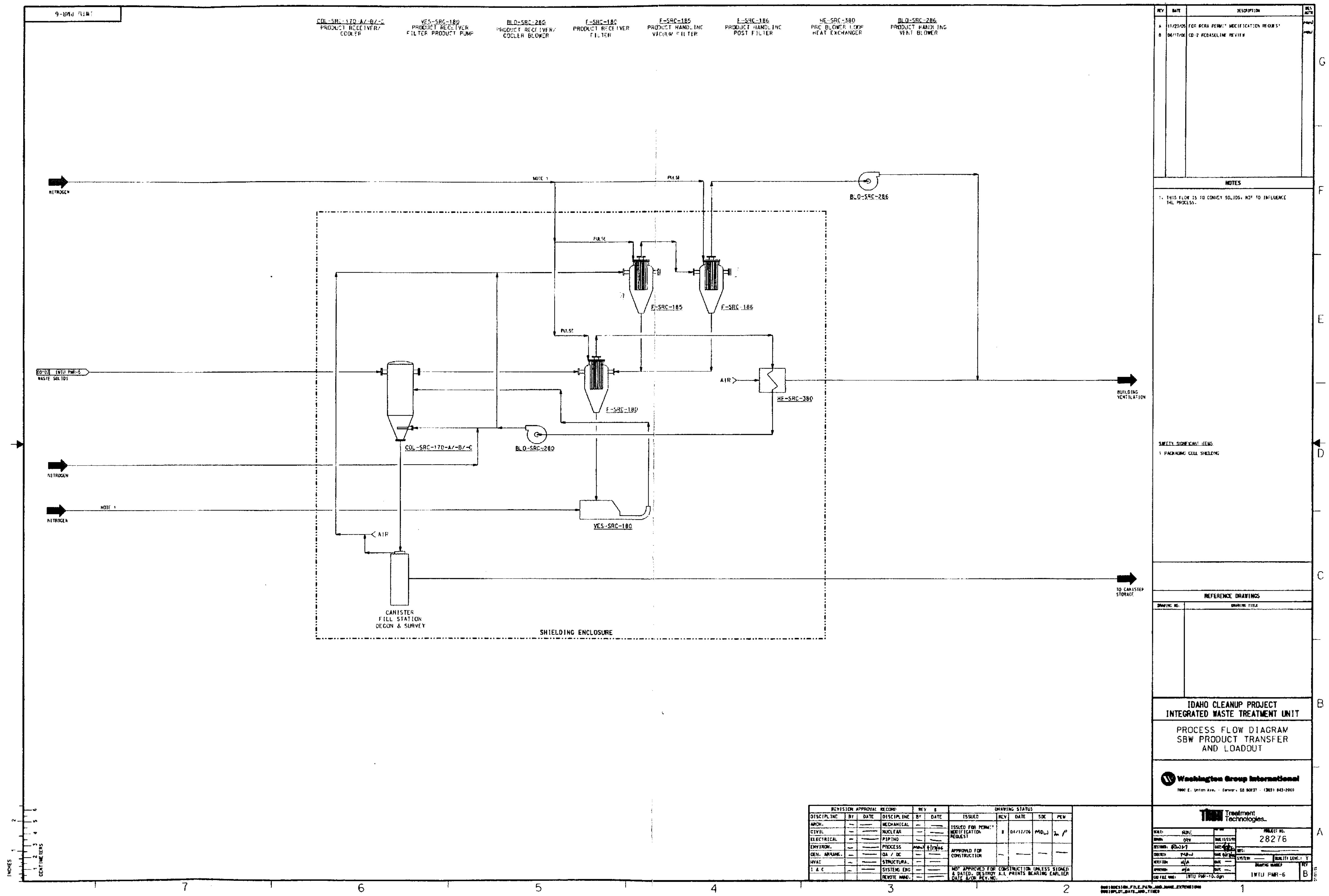

Figure 6. Process Flow Diagram –Treatment Product Transfer and Loadout.

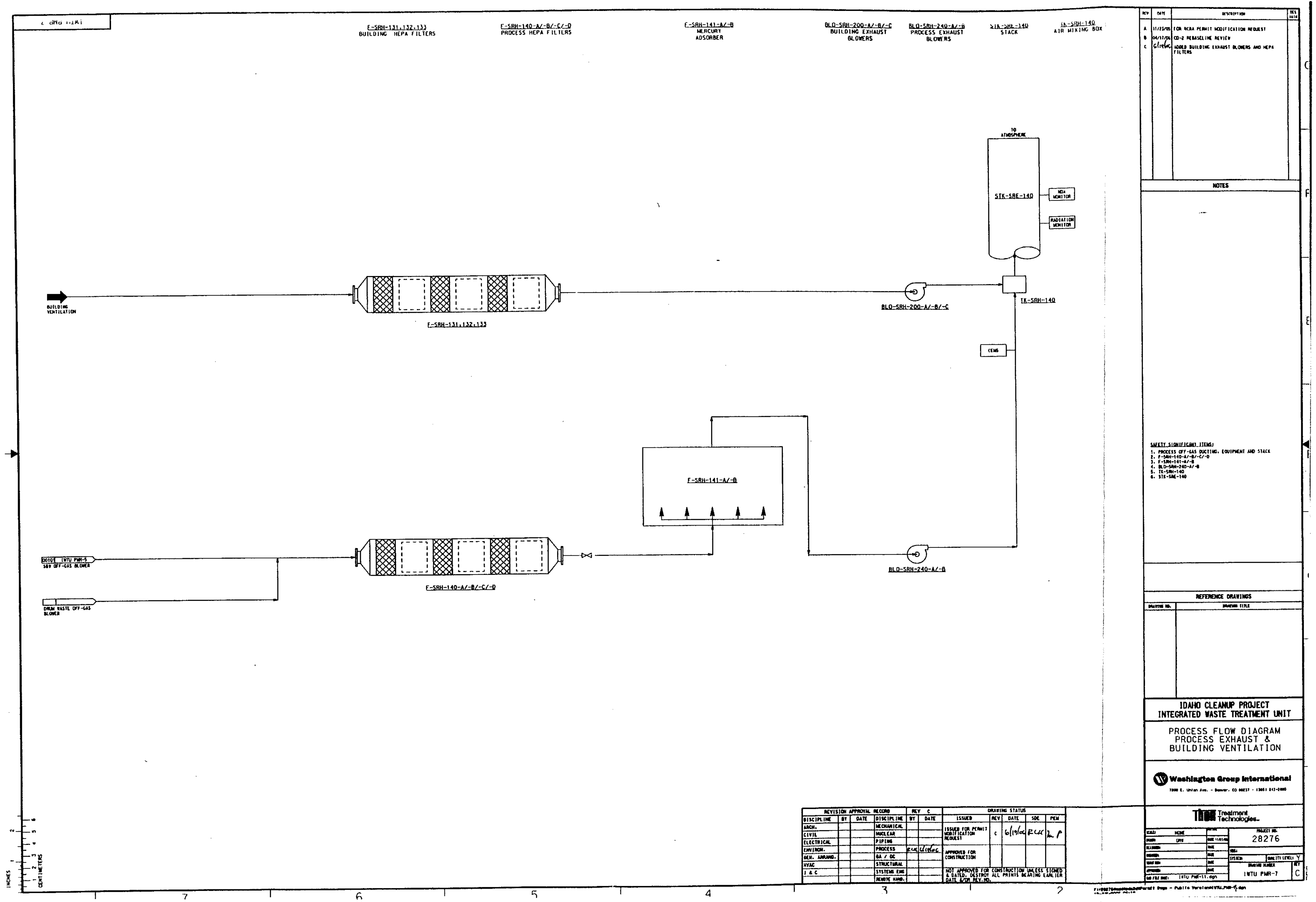

Figure 7. Process Flow Diagram – Process Exhaust and Building Ventilation.

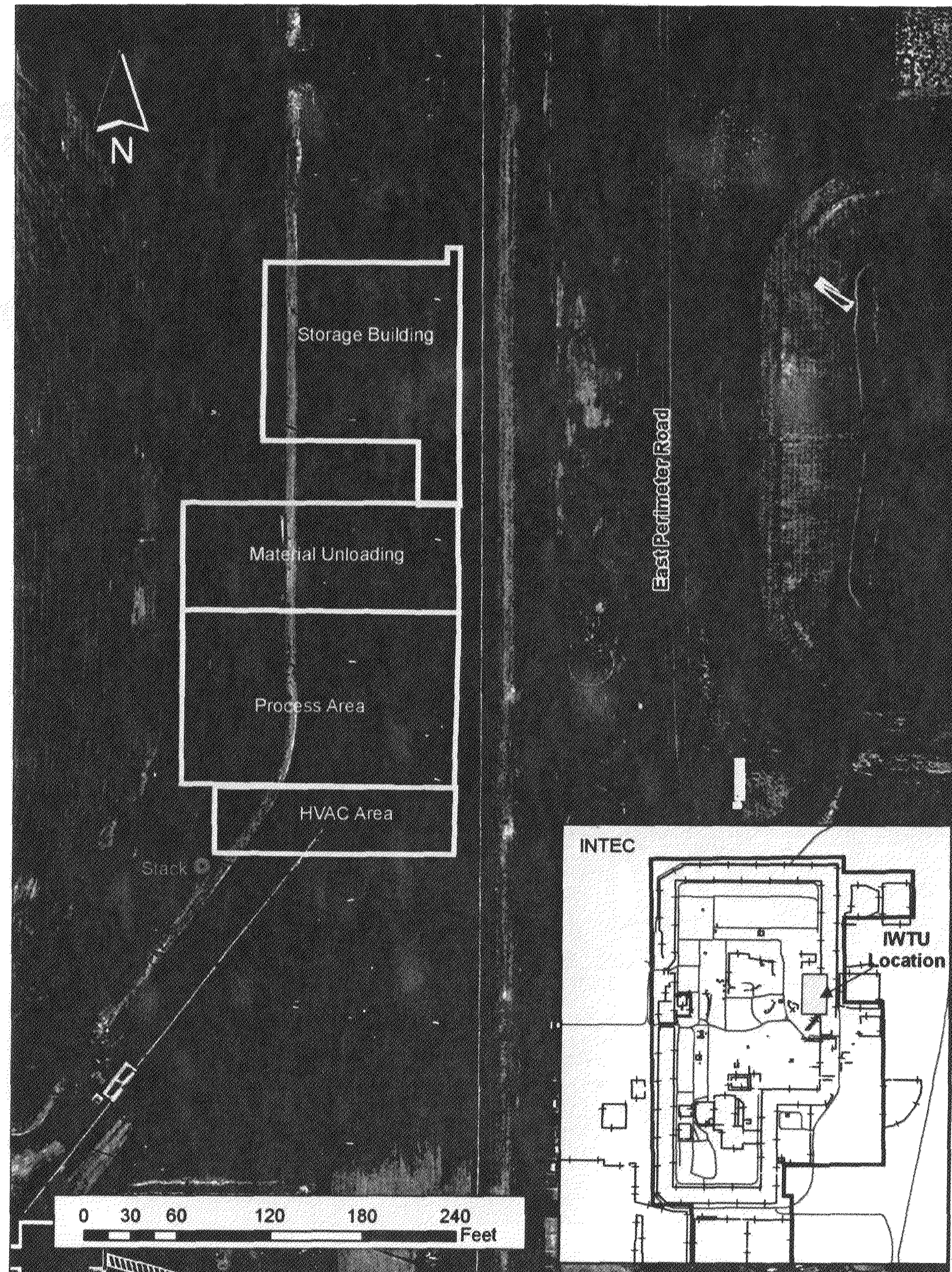

FIGURE 2. IWTU FACILITY
FOOTPRINT AND LOCATION IN THE EAST-CENTRAL PART OF INTEC.

Location and Land Use

The proposed Integrated Waste Treatment Unit Project is located at the Idaho National Laboratory Site, which is a restricted-access, government-owned facility that covers over 2,305 square kilometers (890 square miles) in south-central Idaho. The Idaho National Laboratory Site is on the Snake River Plain having an average elevation of approximately 1,520 meters (5,000 feet) above sea level.

Auer's (1978) land-use classification method for determining urban versus rural dispersion coefficients in the modeling indicates that more than 50% of the land use within three kilometers around the proposed facility appears to be rural. Modeling will be performed with rural dispersion coefficients.

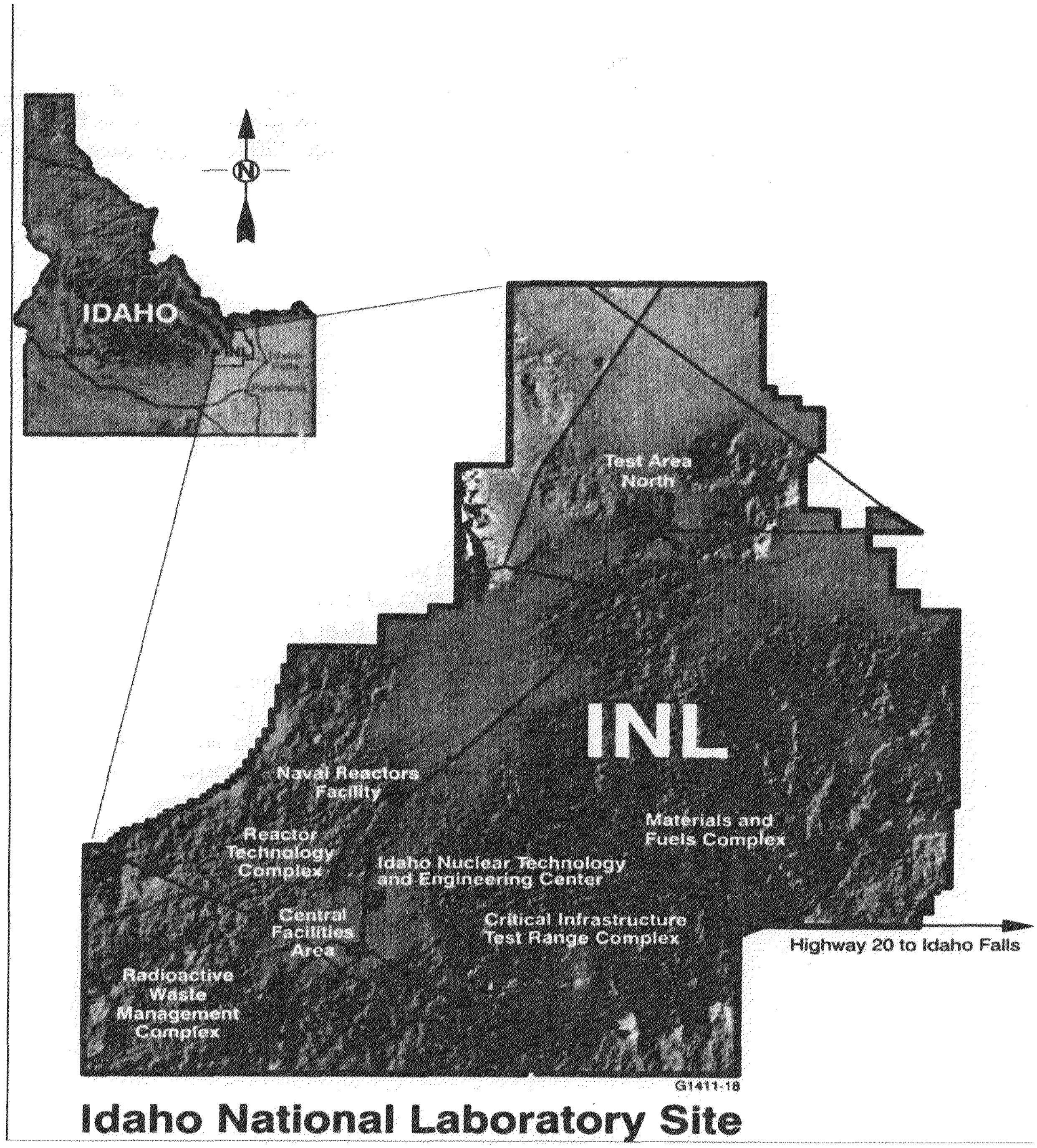

FIGURE 1. LOCATION OF THE IDAHO NUCLEAR TECHNOLOGY CENTER (INTEC) ON THE INL SITE.

Project Description

Facility Location

The IWTU will be located in the east-central part of INTEC on the INL site (Figure 2). The facility will consist of interconnected buildings (Figure 2) including the: 1) vault storage, 2) material unloading and storage, and 3) the process building, which houses the SBW steam reforming processes and controls. The complete facility is approximately 383-feet-long (north-south) by 198-feet-wide (east-west) (Figure 3). The ridge height of the process building is 72 feet. Emissions from the process are exhausted through a single 120-feet-high stack on the southwest corner of the building.

Project Background

From 1952 to 1991, the Department of Energy processed spent nuclear fuel at the Idaho Nuclear Technology and Engineering Center. The process was designed to recover the highly enriched uranium in the fuel using a three-step solvent extraction process. The first solvent extraction cycle resulted in a highly radioactive liquid that was stored at the Idaho Nuclear Technology and Engineering Center Tank Farm Facility. Subsequent extraction cycles, as well as decontamination activities, generated liquid waste that was concentrated by evaporation and was also stored at the Tank Farm Facility. Because of the high sodium content from decontamination activities, this waste has been referred to as sodium bearing waste. In addition, newly generated liquid waste from processes and decontamination activities at the Idaho Nuclear Technology and Engineering Center facilities and from other Idaho National Laboratory facilities has also been evaporated and stored at the Tank Farm Facility. Between the waste resulting from the processing of spent nuclear fuel and newly generated liquid waste, approximately 900,000 gallons of sodium bearing waste are stored in underground stainless steel tanks.

Idaho National Laboratory is proposing a new Integrated Waste Treatment Unit (IWTU) facility designed to receive, treat, and convert sodium bearing waste and newly generated liquid wastes into dry, solid mineral products suitable for packaging, shipment, and disposal at the Waste Isolation Pilot Plant. Idaho National Laboratory is requesting a 15-day review for pre-permit construction approval per IDAPA 58.01.01.213. An air quality impact analysis will be performed per IDAPA 58.01.01.200 in support of a Permit to Construct for the new facility. Idaho regulation requires the facility applying for a permit to construct to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS) and with Toxic Air Pollutant (TAP) standards (IDAPA 58.01.01.210).

This air dispersion modeling protocol is being re-submitted to the Idaho Department of Environmental Quality (DEQ) for approval to fulfill one of the pre-construction requirements prior to the initiation of the air quality modeling for the Idaho National Laboratory IWTU facility. The initial air dispersion protocol was submitted to DEQ on May 23, 2006 and this revised protocol incorporates DEQ comments provided to CH2M HILL. This document summarizes the modeling methodology that will be used to evaluate the facility's impacts to air quality with respect to all criteria pollutants and compliance for a Permit-to-Construct. It has been prepared based on the U.S. Environmental Protection Agency (EPA) Guidelines on Air Quality Models (GAQM), and the State of Idaho Air Quality Modeling Guideline (ID AQ-01, December 31, 2002).

Air Dispersion Modeling Protocol for Idaho National Laboratories Permit-to-Construct Idaho Falls, Idaho

Prepared for

U.S. Department of Energy
Assistant Secretary for Environmental Management
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14516

Submitted to

Idaho Department of Environmental Quality

July 2006

Prepared By

CH2MHILL

McCormick, Rick/BOI

From: Darrin.Mehr@deq.idaho.gov
Sent: Tuesday, July 11, 2006 12:45 PM
To: McCormick, Rick/BOI
Cc: Kevin.Schilling@deq.idaho.gov
Subject: 7/10/06 Discussion of items for INL IWTU modeling protocol

Rick,
I talked the issues we discussed over with Kevin Schilling today and here are the results. Please contact Kevin directly if you have additional questions or INL's modelers have issues with these responses.

MIXING HEIGHTS:
The use of Boise upper air meteorological data is viewed as the appropriate approach for this project. DEQ does not have user-ready data set of upper air data for Boise.

INL may at its option use conservative assumed mixing heights of 50 meters for the 24-hour and shorter averaging period impacts, and 150 meters for the annual averaging periods.

RECEPTOR GRID
A denser spacing of 50 meters along Highway 20/26 will not be required for this project. Use the 100 meter spacing as cited in the protocol.

Several discrete receptors should be placed on Big Southern Butte to verify there are no significant impacts on that terrain feature.

Place a line of discrete receptors along the southern boundary of the INL. This will assist in identifying that your refined receptor grids are adequately located for this project which utilizes different met data than used in the 1999 INTEC modeling demonstration. DEQ may include additional receptors in its verification analyses in order to make certain the maximum ambient impacts have identified.

Darrin Mehr
Air Quality Analyst
Monitoring, Modeling & Emissions Inventory
Idaho Department of Environmental Quality
Phone: 208-373-0536
Fax: 208-373-0143
e-mail: Darrin.Mehr@deq.idaho.gov

above, to be approved. It should be noted, however, that the approval of this modeling protocol is not meant to imply approval of a completed dispersion modeling analysis. Please refer to the *State of Idaho Air Quality Modeling Guideline*, which is available on the Internet at http://www.deq.state.id.us/air/air_permits.htm, for further guidance.

To ensure a complete and timely review of the final analysis, our modeling staff requests that electronic copies of all modeling input files (including BPIP and meteorological data files) and output files are submitted with an analysis report. If you have any further questions or comments, please contact me at (208) 373-0536.

Darrin Mehr
Air Quality Analyst
Monitoring, Modeling & Emissions Inventory
Idaho Department of Environmental Quality
Phone: 208-373-0536
Fax: 208-373-0143
e-mail: Darrin.Mehr@deq.idaho.gov

07/13/2006

Appendix C

Modeling Protocol

McCormick, Rick/BOI

From: Darrin.Mehr@deq.idaho.gov
Sent: Friday, July 07, 2006 2:48 PM
To: McCormick, Rick/BOI
Cc: Kevin.Schilling@deq.idaho.gov; Kenneth.Hanna@deq.idaho.gov; Brian.English@deq.idaho.gov
Subject: Idaho National Laboratory; Integrated Waste Treatment Unit PTC Modeling Protocol Approval

Rick McCormick, P.E.
Project Manager
CH2M HILL
322 Front Street, Suite 200
Boise, ID 83702-7359

RE: Modeling Protocol for a Permit to Construct the Integrated Waste Treatment Unit at the Idaho National Laboratory, Located near Idaho Falls, Idaho

Dear Mr. McCormick:

DEQ received your revised modeling protocol submittal on June 21, 2006. The modeling protocol was submitted on behalf of the Department of Energy, Idaho Operations Office, and in partnership with CH2M HILL/Washington Group Idaho, LLC. The modeling protocol addresses the ambient impact analyses for a permit to construct the Integrated Waste Treatment Unit (IWTU) at the Idaho Nuclear Technology and Engineering Center (INTEC) on the Idaho National Laboratory (INL) facility, which will treat liquid sodium bearing waste into dry solid mineral products for packaging and off-site shipment and disposal.

The modeling protocol documentation has been reviewed and DEQ has the following comments:

1. The protocol states in several places that ISCST3 will be used for the modeling demonstration. The most recent version of BPIP-Prime (building profile and input program with the Prime algorithm) and ISC3-Prime must be used for the analysis.

2. The INL site has a unique situation with regard to ambient air, and DEQ has several comments regarding the receptor grid:
   - Discrete receptors should be spaced at a minimum distance of 50 meters apart for the area close to INTEC along U.S. Highway 20/26, as this is considered ambient air.
   - Several receptors should be placed on the north side of Big Southern Butte to verify that the exhaust plume is not creating impacts on this complex terrain feature.
   - The receptor grid used by INL must be adequate to reasonably resolve the maximum modeled ambient concentrations.

3. INL will be using meteorological (met) data obtained from an on-site tower except for upper air data. Upper air met data for Boise should be used in place of the generic mixing heights discussed in the protocol.

4. Mixing heights should be set at a minimum height of 50 meters to avoid obtaining overly conservative ambient impact predictions due to unrealistically low mixing heights.

5. Provide electronic copies of the raw met data used for the analyses and include a thorough description of the quality assurance and quality control methods used to validate the data.

DEQ's modeling staff considers the submitted dispersion modeling protocol, with the additional items noted

07/13/2006

Appendix C

Modeling Protocol

9. TOXIC AIR POLLUTANT ESTIMATED EMISSIONS *(Include calculations and assumptions)* **See Tables 6 and 8**				
Pollutant	Uncontrolled Emissions		Controlled Emissions	
	lb/hr	tons/yr	lb/hr	tons/yr
	lb/hr	tons/yr	lb/hr	tons/yr
	lb/hr	tons/yr	lb/hr	tons/yr
	lb/hr	tons/yr	lb/hr	tons/yr
	lb/hr	tons/yr	lb/hr	tons/yr
	lb/hr	tons/yr	lb/hr	tons/yr
	lb/hr	tons/yr	lb/hr	tons/yr
	lb/hr	tons/yr	lb/hr	tons/yr

**If units other than tons, please specify.*

1. APPLICANT REFERENCE NUMBER		2. PROCESS OR OPERATION NAME
Operating Permit Number 023-00001- 011-00022		Integrated Waste Treatment Unit

3. MAXIMUM RATED INPUT CAPACITY *(tons/hour)**	4. NORMAL MAXIMUM FEED INPUT		5. NORMAL MAXIMUM PRODUCT OUTPUT	
	tons/hour	tons/year	tons/hour	tons/year
3.5 gal/min	3.5 gal/min			

6. PROCESS EQUIPMENT

Type	Integrated Waste Treatment Unit
Manufacturer	TBD
Model Number	NA
Feed Material	Radioactive aqueous solutions with high concentrations of nitric acid, nitrates, alkali metals, aluminum, and a wide variety of other inorganic oxides

10. POLLUTION CONTROL EQUIPMENT

	Primary	Secondary
Type	Not Required (See Section 2.2)	
Manufacturer		
Model Number		
% Efficiency		

MANUFACTURER GUARANTEED _____ Yes _____ no

(Include guarantee)

For wet scrubbers:

water flow	_____	gpm
pressure drop	_____	inches of water

For baghouses:

air/cloth ratio	_____	
pressure drop	_____	inches of water

7. OPERATING SCHEDULE

Hours per day	24
Days per week	7
Weeks per year	52

8. STACK OR EXHAUST DATA

Stack ID	Stack 1
Height	36.6 m
Exit diameter	1.51 m
Exit gas velocity	17.8 m/s

(Include a separate page for each stack if multiple stacks or vents are used)

11. CRITERIA POLLUTANT ESTIMATED EMISSIONS

See Table 5

Particulates	lb/hr	tons/yr
Sulfur dioxide	lb/hr	tons/yr
Carbon monoxide	lb/hr	tons/yr
Nitrogen oxides	lb/hr	tons/yr
Ozone (VOC)	lb/hr	tons/yr
Fluorides	lb/hr	tons/yr
PM^{10}	lb/hr	tons/yr
Lead	lb/hr	tons/yr

The following information, at a minimum, must be included in the application package in order for the application to be determined complete:

< *A scaled plot plan clearly showing property boundaries and stack and building locations*
< *All calculations and assumptions used to estimate emissions*
< *Manufacturer's guarantees for stated control efficiencies of all control equipment*
< *A description of potential fugitive emissions*
< *A narrative description of the facility and the processed material in to final product out.*
< *A process flow diagram*

STATE OF IDAHO
DEPARTMENT OF ENVIRONMENTAL QUALITY

APPLICATION TO CONSTRUCT AN AIR POLLUTION EMITTING FACILITY
(IDAPA 58.01.01.200-.225)

SECTION 1: GENERAL INFORMATION

1. COMPANY AND DIVISION NAME

CH2M-WG Idaho, LLC (CWI) for the US Department of Energy, Idaho National Laboratory as part of the Idaho Cleanup Project

2. MAILING ADDRESS	COUNTY	NUMBER OF FULL-TIME EMPLOYEES
2525 North Freemont Ave.	Bonneville	Approximately 2,420

3. CITY	STATE	ZIP CODE	TELEPHONE NUMBER
Idaho Falls	Idaho	83415	208-526-1000

4. PERSON TO CONTACT	TITLE
Teresa Perkins	Director, Environmental Support Division

5. EXACT PLANT LOCATION *(IDENTIFY LOCALITY, AND INCLUDE UTM COORDINATES IF KNOWN)*

north-eastern quadrant of the Idaho Nuclear Technology and Engineering Center at the Idaho National Laboratory, Idaho Falls, Idaho

6. GENERAL NATURE OF BUSINESS AND KINDS OF PRODUCTS

Environmental Management, Waste Management, Cleanup

7. REASON FOR APPLICATION

- [ ] permit to construct a new facility
- [ ] permit to modify an existing source
  permit number
- [x] permit to construct a new source at an existing facility
- [ ] change of owner or location
  permit number
  current owner

8. LIST ALL FACILITIES WITHIN THE STATE THAT ARE UNDER YOUR CONTROL OR UNDER COMMON CONTROL AND HAVE EMISSIONS TO THE AIR. IF NONE, SO STATE.

NAME	LOCATION
CWI Managed Sites at the Idaho National Laboratory:	
Idaho Nuclear Technology and Engineering Center	
Test Area North	
Portions of the Radioactive Waste Management Complex and RTC	

9. ESTIMATED CONSTRUCTION START DATE	ESTIMATED COMPLETION DATE
2007	2009

10. NAME AND TITLE OF OWNER OR RESPONSIBLE OFFICIAL

Elizabeth D. Sellers, Manager, DOE-ID and Robert Iotti, President, CWI

11. In accordance with IDAPA 58.01.01.123 (*Rules for the Control of Air Pollution in Idaho*), I certify based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

SIGNATURE	DATE	
SEE CERTIFICATIONS ATTACHED TO TRANSMITTAL		

Appendix B

State of Idaho Department of Environmental Quality Application Forms

Appendix A

Legal Notice – Public Meeting Announcement

Idaho Falls Post Register

LEGAL NOTICE -
Public Meeting Announcement
Idaho National Laboratory
Integrated Waste Treatment Unit, Air Pre-Permit Construction Approval

Notice is hereby given that the U.S. Department of Energy, Idaho Operations Office and CH2M?WG Idaho, LLC will formally submit to the Idaho Department of Environmental Quality an application for an air Permit to Construct the Integrated Waste Treatment Unit (IWTU) at the Idaho Nuclear Technology and Engineering Center (INTEC) on the Idaho National Laboratory on or about August 21, 2006. Included with the Permit to Construct application will be a Request for Pre-Permit Construction approval to allow construction of the Integrated Waste Treatment Unit to begin prior to issuance of the final Permit to Construct. Pre Permit Construction approval will enable the Department of Energy, Idaho Operations Office and CH2M?WG Idaho, LLC to initiate activities that support completion of the Idaho Settlement Agreement milestone to treat the Sodium Bearing Waste inventory managed at INTEC by December 31, 2012.

The Integrated Waste Treatment Unit is comprised of two steam reformers and associated waste transfer and air pollution control equipment to treat Sodium Bearing Waste currently stored at the INTEC Tank Farm Facility and convert it into a solid treatment product that is more suitable for storage and ultimate disposal. This treatment unit is proposed to be constructed and operated at the Idaho National Laboratory Site as implementation of the preferred Sodium Bearing Waste treatment alternative contained in the High Level Waste and Facilities Disposition Environmental Impact Statement Record of Decision as noticed in the December 19, 2005 Federal Register, Vol. 70, No. 242.

The treatment unit will be located at INTEC on the Idaho National Laboratory Site. The Permit to Construct application is being submitted in accordance with the Idaho Administrative Procedures Act (IDAPA) 58.01.01.215.02, *Permit to Construct Procedures for Pre-Permit Construction.*

An informational meeting will be held in Conference Room A/B at the Idaho Falls Public Library, 457 Broadway, Idaho Falls, Idaho, on August 29, 2006, convening at 6:30 p.m. and ending at 7:30 p.m., or ending at 7:00 p.m. if members of the public do not attend. This meeting is being held to encourage public participation and input into the development of this treatment facility. Individuals needing special access to participate in the meeting are encouraged to notify the point of contact listed in this notice at least 72 hours before the meeting.

Please direct comments and questions to Tim Safford, who is the Department of Energy, Idaho Operations Office point of contact for this meeting. He can be reached at (208) 526-5670, or at the following address:

Tim Safford
Department of Energy
Idaho Operations Office
1955 Fremont Ave
Idaho Falls, Idaho 83415-1216
Published: August 10, 2006

Appendix A

Legal Notice – Public Meeting Announcement

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LEGAL NOTICE LEGAL NOTICE

PUBLIC MEETING ANNOUNCEMENT
Idaho National Laboratory
Integrated Waste Treatment Unit,
Air Pre-Permit Construction Approval

Notice is hereby given that the U.S. Department of Energy, Idaho Operations Office and CH2M WG Idaho, LLC will formally submit to the Idaho Department of Environmental Quality an application for an air Permit to Construct the Integrated Waste Treatment Unit (IWTU) at the Idaho Nuclear Technology and Engineering Center (INTEC) on the Idaho National Laboratory on or about August 21, 2006. Included with the Permit to Construct application will be a Request for Pre-Permit Construction approval to allow construction of the Integrated Waste Treatment Unit to begin prior to issuance of the final Permit to Construct. Pre-Permit Construction approval will enable the Department of Energy, Idaho Operations Office and CH2M WG Idaho, LLC to initiate activities that support completion of the Idaho Settlement Agreement milestone to treat the Sodium Bearing Waste inventory managed at INTEC by December 31, 2012.

The Integrated Waste Treatment Unit is comprised of two steam reformers and associated waste transfer and air pollution control equipment to treat Sodium Bearing Waste currently stored at the INTEC Tank Farm Facility and convert it into a solid treatment product that is more suitable for storage and ultimate disposal. This treatment unit is proposed to be constructed and operated at the Idaho National Laboratory Site as implementation of the preferred Sodium Bearing Waste treatment alternative contained in the High Level Waste and Facilities Disposition Environmental Impact Statement Record of Decision as noticed in the December 19, 2005 Federal Register, Vol. 70, No. 242.

The treatment unit will be located at INTEC on the Idaho National Laboratory Site. The Permit to Construct application is being submitted in accordance with the Idaho Administrative Procedures Act (IDAPA) 58.01.01.213.02, Permit to Construct Procedures for Pre-Permit Construction.

An informational meeting will be held in Conference Room A/B at the Idaho Falls Public Library, 457 Broadway, Idaho Falls, Idaho, on August 28, 2006, commencing at 6:30 p.m. and ending at 7:30 p.m., or ending at 7:00 p.m. if members of the public do not attend. This meeting is being held to encourage public participation and input into the development of this treatment facility. Individuals needing special access to participate in the meeting are encouraged to notify the point of contact listed in this notice at least 72 hours before the meeting.

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(Pub. Aug. 10, 2006)

Appendix A

Legal Notice – Public Meeting Announcement

40 CFR 70, 2006, "State Operating Permit Programs," *Code of Federal Regulations*, Office of Federal Register, May 16, 2005.

Boiler Permit, #P-030505, 1-21-04 (Table 3) (§4.1.3).

DEQ, 2002, "State of Idaho Air Quality Modeling Guideline," AQ-011, Rev. 1, Idaho Department of Environmental Quality, December 31, 2002.

DOE Order 413.3, 2005, "Program and Project Management for the Acquisition of Capital Assets," U.S. Department of Energy, November 2, 2005.

DOE-ID, 2002, *Environmental Management Performance Management Plan for Accelerating Cleanup of Idaho National Engineering and Environmental Laboratory*, DOE/ID-11006, U.S. Department of Energy Idaho Operations Office, July 2002.

EDF-6495, 2006, "Mass and Energy Balance for Sodium Bearing Waste Integrated Waste Treatment Unit – Modified to Support Emissions Permitting," Rev. 0, Idaho Cleanup Project, May 30, 2006.

IDAPA 58.01.01, 2006, "Rules for the Control of Air Pollution in Idaho," Idaho Administrative Procedures Act, Idaho Department of Environmental Quality, 2006.

INEEL, 1999, *Screening Level Risk Assessment for the New Waste Calcining Facility*, INEEL/EXT-97-00686, Rev. 5a, Idaho National Engineering and Environmental Laboratory, May 1999.

Staley, C. S., M. L. Abbott, and P. D. Ritter, 2004, *INEEL Air Modeling Protocol*, INEEL/EXT-04-02511, Idaho National Engineering and Environmental Laboratory, December 2004.

Tier I Permit, #TI-030520, 6-06-06 (§1).

<u>40 CFR 61.94 and 95</u>
COMPLIANCE REPORTING AND RECORDKEEPING REQUIREMENTS

INL shall submit an annual report and maintain records documenting radionuclide emissions and effective dose equivalent values in accordance with 40 CFR 61.94 and 61.95. Emissions from the IWTU will be included in future annual reports submitted to DEQ and EPA by INL.

<u>40 CFR 63</u>
NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS FOR SOURCE CATEGORIES

40 CFR 61, Subpart H, is the only NESHAP that applies to this project. No other NESHAP standards apply to this project because no other source categories are applicable.

<u>40 CFR 64</u>
COMPLIANCE ASSURANCE MONITORING

Compliance Assurance Monitoring (CAM) provisions are not applicable to the proposed new source. To be subject to CAM a source must meet ALL of the following criteria:

- Located at a major source required to obtain a Title V operating permit;
- Subject to an emission limitation or standard for the applicable regulated air pollutant that is not exempt;
- A control device is used to achieve compliance with the emission limitation or standard;
- The potential uncontrolled emissions of the applicable regulated air pollutant are greater than or equal to the major source thresholds (100 tons per year of particulate matter (PM_{10}), nitrogen oxides (NO_X), sulfur dioxide (SO_2), volatile organic compounds (VOC), carbon monoxide (CO), or lead, 10 tons per year of any hazardous air pollutant (HAP), or 25 tons per year of any combination of HAPs); and
- The pollutant specific emissions unit is not an exempt backup utility power emissions unit.

The potential emissions of PM_{10}, NO_X, SO_2, VOC, and HAPs do not meet or exceed the thresholds. Control devices are not present at the emissions unit for NO_X, VOC, CO, or HAPs.

7. REFERENCES

40 CFR 52, 2006, "Approval and Promulgation of Implementation Plans," *Code of Federal Regulations*, Office of the Federal Register, June 29, 2006.

40 CFR 61, 2006, "National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, Office of Federal Register, June 7, 2006.

40 CFR 63, 2006, "National Emission Standards for Hazardous Air Pollutants for Source Categories," *Code of Federal Regulations*, Office of the Federal Register, June 30, 2006.

Sample Calculation:

Process feed rate =	795 liter/hr	(3.5 gal/min)×(3.7854 liter/gal)× (60 min/hr)
Density of waste =	1.3 kg/liter	
Process mass rate =	1,033 kg/hr	(795 liter/hr) × 1.3 kg/liter
PW=	2,273 lb/hr	(1,033 kg/hr) × 2.2 lb/kg
E=	**4.65 lb/hr**	**allowable emissions**
PM_{10} uncontrolled emissions=	**0.04 lb/hr**	**below allowable emissions**

INL has demonstrated compliance with the particulate matter (PM) process weight limitations. For the maximum production rate of 2,273 pounds of liquid waste per hour input to the IWTU, the allowable PM emission rate is 4.65 pound/hour of PM_{10}. The allowable emission rate is determined using the previous equation, where E is the allowable emission rate and PW is the process weight in pounds per hour.

IDAPA 58.01.01.776
GENERAL RESTRICTIONS

No emission of odorous gases, liquids, or solids into the atmosphere in such quantities as to cause air pollution is anticipated.

6.2 Federal Applicable Requirements

40 CFR 61 SUBPART H
NATIONAL EMISSIONS STANDARDS FOR EMISSIONS OF RADIONUCLIDES OTHER THAN RADON FROM DEPARTMENT OF ENERGY FACILITIES

40 CFR 61.92
STANDARD

Emissions of radionuclides to the ambient air shall not exceed those amounts that would cause any member of the public to receive a dose equivalent of greater than 10 mrem/year from the INL. This information has been prepared in an Approval to Construct application submitted to the Environmental Protection Agency (EPA) Region 10 with a copy sent to the DEQ. The EDE to a hypothetical maximally exposed individual from the IWTU is estimated at 0.0746 mrem/yr.

40 CFR 61.93
EMISSION MONITORING AND TEST PROCEDURES

INL shall determine the radionuclide emissions and calculate the dose equivalent values to members of the public using EPA-approved procedures, and as provided in Subpart H.

IDAPA 58.01.01.590
NEW SOURCE PERFORMANCE STANDARDS

There are no new source performance standards applicable to the IWTU.

IDAPA 58.01.01.591
NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS

The proposed source is regulated under 40 CFR 61, Subpart H. The requirements of 40 CFR 61, Subpart H, "National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities," apply to this project. This is the only NESHAP applicable to this source. These requirements are already specified for all the emission units in the INL Tier I Operating Permit, Section 2, Facility-Wide Conditions. Compliance is demonstrated by meeting the requirements in the Tier I Operating Permit.

IDAPA 58.01.01.625
VISIBLE EMISSIONS

"A person shall not discharge any air pollutant into the atmosphere from any point of emission for a period or periods aggregating more than three (3) minutes in any sixty (60) minute period which is greater than twenty percent (20%) opacity as determined by this section."

This standard will need to be included in the PTC and compliance with this standard will be demonstrated by complying with the opacity monitoring provisions in the facility-wide section of the INL Tier I Operating Permit.

IDAPA 58.01.01.650 and 651
RULES FOR CONTROL OF FUGITIVE DUST AND GENERAL RULES

All reasonable precautions shall be taken to prevent fugitive dust from becoming airborne. Consideration shall be given to proximity to human habitation and dust-generating activities.

Best management practices, such as water spray or covered trucks, will be used to control fugitive dust emissions from becoming airborne during construction and throughout the project, as necessary. No dust generating materials are expected to be exposed in the process, road surfaces are paved, and the site is not proximate to human habitation.

IDAPA 58.01.01.701
PARTICULATE MATTER – PROCESS WEIGHT LIMITATIONS

"No person shall emit into the atmosphere from any process or process equipment commencing operations on or after October 1, 1979 particulate emissions in excess of the amount shown by the following equation.

The process weight is less than 9,250 pounds per hour. Therefore, the Allowable Emission Rate (E) = $0.045(PW)^{0.60}$."

IDAPA 58.01.01.213.02.A
INFORMATIONAL MEETING

"Within ten (10) days after the submittal of the pre-permit construction approval application, the owner or operator shall hold an informational meeting in at least one (1) location in the region in which the stationary source or facility is to be located. The informational meeting shall be made known by notice published at least ten (10) days before the meeting in a newspaper of general circulation in the county(ies) in which the stationary source or facility is to be located. A copy of such notice shall be included in the application."

An informational meeting will be held in Idaho Falls on August 28, 2006. See a copy of the Legal Notice in Appendix A.

IDAPA 58.01.01.224
PERMIT TO CONSTRUCT APPLICATION FEE

INL satisfied the PTC application fee requirement by submitting a fee of $1,000 at the time the original application was submitted, on or about August 21, 2006.

IDAPA 58.01.01.225
PERMIT TO CONSTRUCT PROCESSING FEE

The total emissions from the proposed new facility are between 10 and 100 tpy. Therefore, the associated processing fee is $5,000. It is INL's understanding that DEQ will issue a letter confirming the processing fee amount. No permit to construct can be issued without first paying the required processing fee.

IDAPA 58.01.01.380 and 381
CHANGES TO TIER I OPERATING PERMITS AND ADMINISTRATIVE PERMIT AMENDMENTS

INL is requesting that the Tier I Operating Permit be changed as an Administrative amendment. Under IDAPA 58.01.01.381.01.e, the amendment is to incorporate into the Tier I Operating Permit requirements from a PTC issued by DEQ in accordance with Subsection 209.05.c.

IDAPA 58.01.01.577, et seq.
AMBIENT AIR QUALITY STANDARDS FOR SPECIFIC AIR POLLUTANTS (PM_{10}, SO_2, NO_X, CO, Pb)

Site specific modeling has been performed for the proposed source. Results of this modeling demonstrate compliance with all applicable standards, see Table 8.

IDAPA 58.01.01.578
DESIGNATION OF ATTAINMENT, UNCLASSIFIABLE, AND NONATTAINMENT AREAS

The proposed site for the stationary sources is in an attainment area; this classification is verified in the INL Tier I Operating Permit.

IDAPA 58.01.01.200
PROCEDURES AND REQUIREMENTS FOR PERMITS TO CONSTRUCT

Upon Pre-Permit Construction approval by DEQ, INL will follow the procedures and requirements outlined under IDAPA 58.01.01.200 for obtaining a Permit to Construct.

IDAPA 58.01.01.201
PERMIT TO CONSTRUCT REQUIRED

The facility's proposed project does not meet the exemption criteria in Sections 220 through 223 of the rules; therefore a Permit to Construct is required.

IDAPA 58.01.01.203.02
NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

The applicant has demonstrated that the facility will comply with all applicable emissions standards, ambient air quality standards, and toxic increments. In particular, in the application it has been shown that the facility will not cause or significantly contribute to a violation of any air quality standard.

Compliance with this requirement has been demonstrated by modeling, see Table 8.

IDAPA 58.01.01.205, (40 CFR 52.21)
PERMIT REQUIREMENTS FOR NEW MAJOR FACILITIES OR MAJOR MODIFICATIONS IN ATTAINMENT OR UNCLASSIFIABLE AREAS

Section 205 incorporates the federal PSD rule requirements.

INL reviewed this project for PSD applicability and determined that the emissions increase from the project do not meet or exceed a significant threshold as defined at IDAPA 58.01.01.006, see Table 5.

IDAPA 58.01.01.210
DEMONSTRATION OF PRECONSTRUCTION COMPLIANCE WITH TOXIC STANDARDS

"In accordance with Subsection 203.03, the applicant shall demonstrate preconstruction compliance with Section 161 to the satisfaction of the Department. The accuracy, completeness, execution and results of the demonstration are all subject to review and approval by the Department."

INL has demonstrated preconstruction compliance for all TAPs identified in this permit application. See emission estimates presented in Tables 3 through 6 and modeling results in Table 8.

IDAPA 58.01.01.213
PRE-PERMIT CONSTRUCTION

INL will comply with procedures and regulations outlined in this section in order to obtain Pre-Permit Construction approval as discussed in Section 1 of this application.

Idaho TAPs were first screened against the hourly emission levels in IDAPA 58.01.01.585 and 586. Air dispersion modeling was required for TAPs exceeding screening levels, which included: aluminum, arsenic, beryllium, calcium oxide, cadmium, chlorine, chromium III, fluoride, hydrochloric acid, mercury, and nickel. Modeling successfully demonstrated permit approval compliance with the acceptable ambient concentrations for carcinogenic and non-carcinogenic pollutants per IDAPA 58.01.01.585 and 586. In addition, pre-construction compliance requirements were also satisfied for Idaho TAPs per IDAPA 58.01.01.210.

ISC3-PRIME modeling files are on the enclosed CD (Attachment 1).

6. APPLICABLE REQUIREMENTS

This section describes the regulatory analysis of applicable air quality rules with respect to this application. The state rules or regulations followed by the applicable federal rules or regulations are presented below.

6.1 State Applicable Requirements

The following are applicable under IDAPA 58.01.01, "Rules for the Control of Air Pollution in Idaho":

IDAPA 58.01.01.130-136
STARTUP, SHUTDOWN, SCHEDULED MAINTENANCE, SAFETY MEASURES, UPSET AND BREAKDOWN

If an excess emission event occurs during startup, shutdown, scheduled maintenance, safety measures, upset, or breakdown, INL will comply with applicable sections of IDAPA 58.01.01.130 through 58.01.01.136, relating to excess emissions, correction of condition, startup, shutdown and scheduled maintenance requirements, upset, breakdown and safety requirements, excess emission reports and records.

IDAPA 58.01.01.157
TEST METHODS AND PROCEDURES

If an emission test is required, INL will adhere to procedures outlined in IDAPA 58.01.01.157.

IDAPA 58.01.01.161
TOXIC SUBSTANCES

"Any contaminant which is by its nature toxic to human or animal life or vegetation shall not be emitted in such quantities or concentrations as to alone, or in combination with other contaminants, injure or unreasonably affect human or animal life or vegetation."

In accordance with IDAPA 58.01.01.585/586, emission estimates and modeling results expected from the processes are presented in Table 6 and Table 8, respectively, which detail that emissions do not have the impacts addressed by the regulation.

Table 8. Summary of IWTU modeling results for specific pollutants.

Pollutant	Averaging Time	Total Emissions (tpy)	Total Emissions (lb/hr)	Total Emissions[a] (g/s)	Modeled Conc. ($\mu g/m^3/g/s$)	Estimated Ambient Conc. ($\mu g/m^3$)	Significant Contribution Levels ($\mu g/m^3$)	Below Significant Contribution Levels	IDAPA 58.01.01.585/586 AAC/AACC ($\mu g/m^3$)	Below IDAPA 58.01.01.585/586 AAC/AACC
NO_X	Annual	31.77	7.253	0.91	0.06136	0.056	1.0	Yes	NA[b]	NA
SO_2	Annual	5.2	1.187	0.15	0.06136	0.009	1.0	Yes	NA	NA
	24-hr	NA	1.187	0.15	1.49124	0.223	5.0	Yes	NA	NA
	3-hr	NA	1.187	0.15	5.55767	0.831	25.0	Yes	NA	NA
Toxic Air Pollutants										
Aluminum (Al)	24-hr	NA	3.31E+01	4.17E+00	1.49124	6.22	NA	NA	100	Yes
Arsenic (As)	Annual	NA	3.16E-04	2.68E-05	0.06136	1.64E-06	NA	NA	2.3E-04	Yes
Beryllium (Be)	Annual	NA	2.02E-04	1.71E-05	0.06136	1.05E-06	NA	NA	4.2E-03	Yes
Calcium Oxide (CaO)	24-hr	NA	6.82E+00	8.59E-01	1.49124	1.28	NA	NA	100	Yes
Cadmium (Cd)	Annual	NA	5.04E-01	4.27E-02	0.06136	2.62E-03	NA	NA	5.6E-03[c]	Yes
Chlorine (Cl_2)	24-hr	NA	2.05E+00	2.58E-01	1.49124	0.39	NA	NA	150	Yes
Chromium III (Cr)	24-hr	NA	5.06E-01	6.38E-02	1.49124	0.095	NA	NA	25	Yes
Fluoride (F)	24-hr	NA	1.19E+00	1.50E-01	1.49124	0.22	NA	NA	125	Yes
Hydrochloric Acid (HCl)	24-hr	NA	2.11E+00	2.66E-01	1.49124	0.40	NA	NA	375	Yes
Mercury (Hg)	24-hr	NA	3.23E+00	0.41	1.49124	0.61	NA	NA	2.5	Yes
Nickel (Ni)	Annual	NA	2.02E-01	1.71E-02	0.06136	1.05E-03	NA	NA	4.2E-03	Yes

a. Carcinogenic pollutant emission rate based on annualized average (see example calculation for arsenic below and EDF-6495, Section 5).
b. NA = not applicable to the listed air pollutant
c. AACC adjusted by a factor of 10 (as specified in IDAPA 58.01.01.210.15) based on the short term life of the IWTU (design life of 5 years).

Example Calculations:

NO_X estimated ambient conc.: (0.91 g/s) × (0.06136 $\mu g\text{-}s/g\text{-}m^3$) = 0.056

Arsenic estimated ambient conc. (carcinogens): (3.16E-04 lb/hr) × (453.59 g/lb)/(3,600 s/hr) × (4,206 hr/yr)/(8,760 hr/yr) × 1.4 (0.06136 $\mu g\text{-}s/g\text{-}m^3$) = 1.64E-06 $\mu g/m^3$

Aluminum estimated ambient conc. (non-carcinogens): (4.17 g/s) × (1.49124 $\mu g\text{-}s/g\text{-}m^3$) = 6.22 $\mu g/m^3$

Table 7. Summary of IWTU modeling results for generic pollutants.

Source	Grid	Description	Maximum Conc.	Units
IWTU	INL	Off-site vapor annual conc.	0.06136	$\mu g/m^3/g/s$
IWTU	HWY	US 20/26 vapor 24-hr conc.	1.49124	$\mu g/m^3/g/s$
IWTU	HWY	US 20/26 vapor 3-hr conc.	5.55767	$\mu g/m^3/g/s$

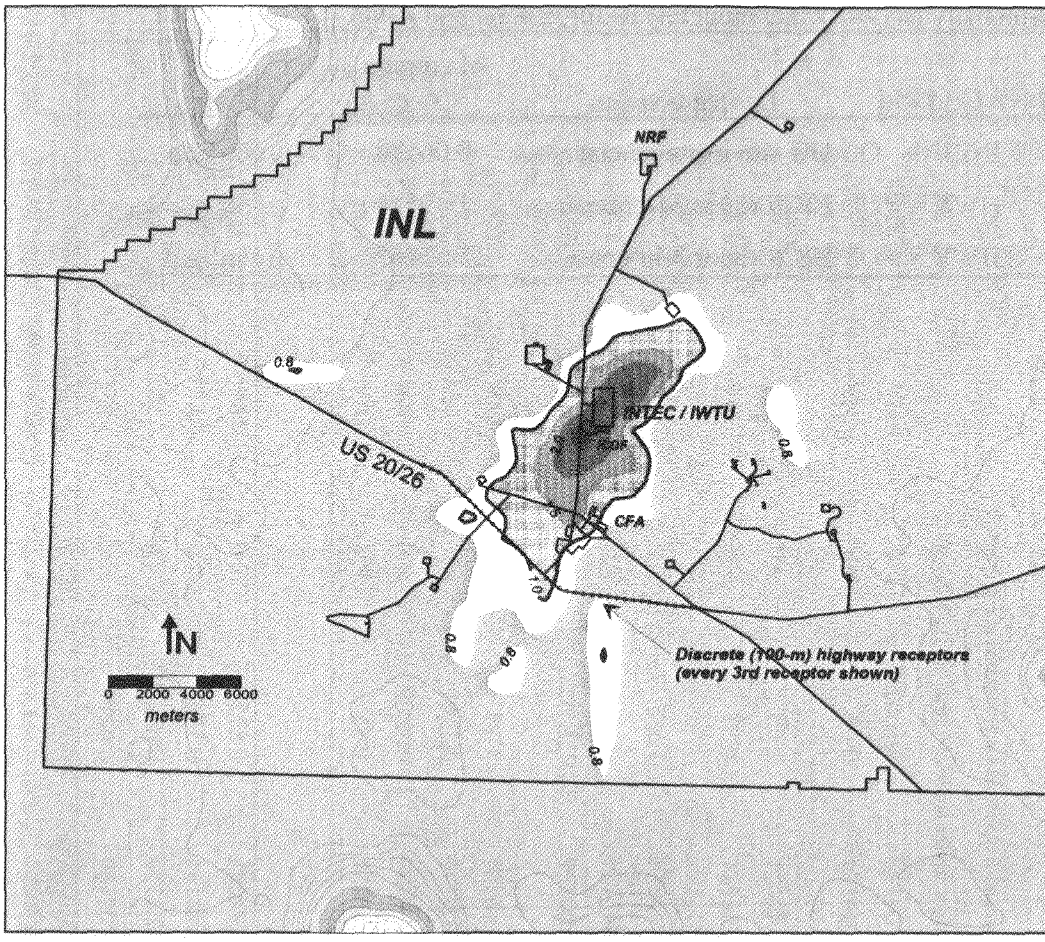

Figure 9. "HWY" grid. Discrete (100-m interval) receptors along the major impact area on US Highway 20/26 (dotted line) used for evaluating maximum short-term (24-hour) inhalation impacts. Note that this figure shows only the proposed grid spacing. The isopleths are from modeling runs performed for other purposes and are not representative of emissions from the IWTU.

Air dispersion modeling was performed as described in the approved air modeling protocol (Staley et al. 2004). Air modeling was performed to evaluate the atmospheric dispersion of pollutants from the IWTU stack to downwind locations at which members of the public could potentially be exposed to emissions from the facility. The EPA-approved ISC3-PRIME (Version 04269) air dispersion model was utilized. This is consistent with approved modeling currently being done at the Site for risk assessments. The Building Profile Input Program for PRIME (BPIPPRM version 04274) was used to assess potential building downwash of the IWTU stack. Dispersion modeling was performed using a 1 gram per second (g/s) release of a generic particulate pollutant (see Table 7). Model output for maximum air concentrations (μ/cubic meter per g/s released) was multiplied by pollutant-specific release rates (g/s) to obtain pollutant-specific results. Table 8 summarizes the pollutant-specific results.

Nitrogen oxides (NO_X) and sulfur dioxide (SO_2) emission rates were modeled because these two criteria pollutants were above the modeling thresholds, Table 1, Modeling thresholds for criteria pollutants, "State of Idaho Air Quality Modeling Guideline," (DEQ 2002). The modeling results are below the significant contribution levels and demonstrate compliance with the National Ambient Air Quality Standards (NAAQS).

- **HWY:** Discrete receptors placed at 100-m intervals along major impact areas of US Highway 20/26 (160 total receptors), which traverses the southern portion of the INL Site (Figure 9). The area of maximum impact along the highway was determined from previous INTEC main stack modeling (INEEL 1999). These receptors will only be evaluated for short-term direct inhalation impacts from non-carcinogens because the only potential receptors are transient motorists. A 24 hour averaging time was selected for modeling to be consistent with the State of Idaho Acceptable Ambient Concentrations (AACs) for non-carcinogenic toxic air pollutants.

This practice is acceptable to the DEQ and has been used for previous modeling studies on the INL Site.

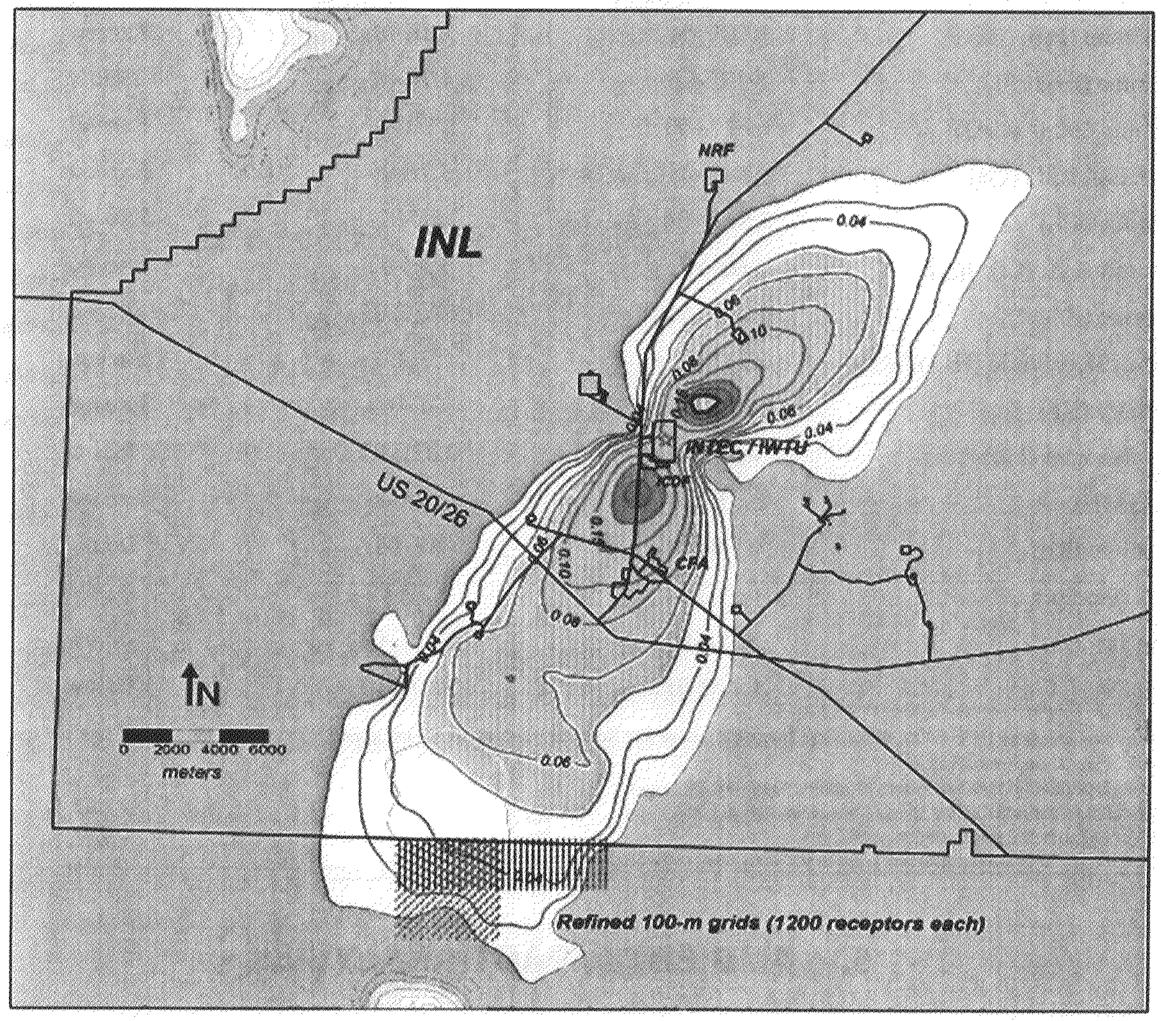

Figure 8. "INL Site" boundary grids. Two refined (100-m spacing) receptor grids at the INL Site boundary and Big Southern Butte area were used for evaluating maximum off-site impacts. Note that this figure shows only the example grid spacing. The isopleths are from modeling runs performed for other purposes and are not representative of emissions from the IWTU.

Table 6. Summary of IWTU potential toxic air pollutant emissions.

Pollutant[a]	Potential Uncontrolled Emission Rate[b] (lb/hr)	IDAPA 58.01.01.585/586 Emission Level (lb/hr)	Potential Toxic Emission Rate vs. Emission Level
Silver (Ag)	7.76E-04	1E-03	Below
Aluminum (Al)	3.31E+01	1.33E-01	**Exceeds**
Arsenic (As)	3.16E-04	1.5E-06	**Exceeds**
Barium(Ba)	1.95E-02	3.3E-02	Below
Beryllium (Be)	2.02E-04	2.8E-05	**Exceeds**
Bromine (Br_2)	6.10E-05	4.7E-02	Below
Calcium Oxide (CaO)[c]	6.82E+00	1.33E-01	**Exceeds**
Cadmium (Cd)	~~5.04E-01~~ 1.51E-04	3.7E-06	**Exceeds**
Chloride (Cl_2)[d]	2.05E+00 revised	2E-01	**Exceeds**
Chromium III (Cr)	5.06E-01 11/22/06	3.3E-02	**Exceeds**
Fluoride (F)[e]	1.19E+00 KH	1.67E-01	**Exceeds**
Hydrochloric Acid (HCl)	2.11E+00	5E-02	**Exceeds**
Mercury (Hg)	3.23E+00	3E-03	**Exceeds**
Molybdenum (Mo)	4.81E-02	3.33E-01	Below
Nickel (Ni)	2.02E-01	2.7E-05	**Exceeds**
Rhodium (Rh)	9.28E-04	1E-03	Below
Selenium (Se)	1.58E-04	1.3E-02	Below
Tin (Sn)	1.05E-02	1.33E-01	Below
Zinc (Zn)	1.16E-01	6.67E-01	Below

a. Pollutants based on EDF-6495, "Mass and Energy Balance For Sodium Bearing Waste Integrated Waste Treatment Unit-Modified to Support Emissions Permitting."
b. Uncontrolled emission rate refers to unabated emissions.
c. All calcium expected in the off-gas was assumed as CaO.
d. All chlorine in the emissions assumed as Cl_2.
e. Fluoride is a regulated pollutant, pounds per hour total evaluated.

5. AMBIENT IMPACT ANALYSIS

An air dispersion modeling protocol was prepared and submitted to the DEQ on June 21, 2006. The source parameters and modeling assumptions were identified within the modeling protocol. A copy of the approved protocol and DEQ's approval are included in Appendix C.

Ambient air is defined by the following two receptor (RE) grids:

- **INL Site:** Two refined (100-m spacing) grids, based on previous studies, are placed in areas of maximum impact along the INL Site south boundary and in the Big Southern Butte (BSB) area based on previous INTEC main stack modeling studies (INEEL 1999) (Figure 8). The INL Site boundary grid consists of 7 rows of 36 receptors (252 receptors). The BSB grid consists of 19 rows of 20 receptors (380 total).

Table 5. Summary of PSD regulated pollutant emissions.

Pollutant	Projected Boiler Emissions – Uncontrolled[a] (tpy)	IWTU Potential Emissions – Uncontrolled[b] (tpy)	Total Regulated Emissions (tpy)	Significant Emission Rate Threshold (tpy)	Significant Emission Rate Exceeded?
Total Particulate Matter (PM)	0.65	0.04	0.69	25	No
PM_{10}	0.35	0.04	0.39	15	No
Nitrogen Oxides (NO_X)	6.53	31.77	38.30	40	No
Volatile Organic Compounds (VOC)	0.08	0.00	0.08	40	No
Sulfur Oxides (SO_2)	13.91	5.20	19.11	40	No
Carbon Monoxide (CO)	1.63	1.44	3.07	100	No
Lead	0.0004	1.15E-06	0.0004	0.6	No
Fluorides	0.00	0.06	0.06	3.0	No

a. Projected emissions are a sum of emissions from the boiler incremental increase (presented in Table 3 of this document) (e.g., PM = (1,306 lb/yr)/(2000 lb/ton) = 0.65 ton/yr).
b. IWTU potential emissions are a sum of uncontrolled emissions from the total liquid waste to be treated (presented in Table 4 of this document).

4.1.3 Step 3. Sum the Associated Boiler and the IWTU Potential Emissions and Compare to Significant Emissions Thresholds

Table 5 summarizes the contribution of regulated pollutants from the incremental boiler demand and the potential emissions from the new IWTU. In no case do the combined emissions of the boilers and IWTU exceed a PSD threshold. These combined emissions do not constitute a major modification to a major source. Nitrogen oxide (NO_X) emissions are the closest pollutant to the threshold with an estimated combined total of 38.30 tpy compared to a PSD threshold of 40 tpy.

No significance thresholds are exceeded; therefore no further PSD evaluation (such as netting) is required. The annual emission rates are based on processing a maximum amount of 1,236,000 gallons of liquid waste through the IWTU. The existing CPP-606 boilers can provide the steam needed by the IWTU within the allowable limit of the current boiler air permit (PTC, P-030505, January 21, 2004). Therefore, the emissions increase for the permitted boilers would be zero for purposes of doing a National Ambient Air Quality Standards (NAAQS) analysis for this project.

4.2 IWTU Criteria Pollutant Emissions

For permitting purposes, only emissions emanating from the IWTU main stack need to be evaluated. The potential uncontrolled (unabated) emission rates as established in Table 4, IWTU Potential Emissions, are the project specific emissions being evaluated in accordance with PTC procedures and requirements per IDAPA 56.01.01.200 and NAAQS analysis in Section 5. The criteria pollutants include: carbon monoxide (CO), nitrogen oxides (NO_X), sulfur dioxide (SO_2), particulate matter (PM) lead, and fluorides. Note that PM is assumed to equal PM_{10}. Fluoride is also considered an Idaho toxic air pollutant (TAP) and is included in the analysis in Section 4.3.

4.3 State Toxic Air Pollutants

INL has conservatively estimated TAPs based on no emission controls (unabated emissions), and has performed unabated (no emission controls) and abated (emissions control equipment) pilot testing to simulate the treatment of liquid waste (see EDF-6495). Although pilot testing has shown that many of the TAPS are further reduced with the addition of emissions control equipment, such as HEPA filters and a mercury GAC adsorber, the abated toxic emission results are not included as part of this PTC application. ICP is not taking credit for treating any toxics with emissions control equipment to illustrate that even under worst case conditions toxic emissions are below IDAPA screening levels or acceptable ambient concentrations for carcinogenic and non-carcinogenic pollutants.

Table 6 summarizes the potential TAP emission rates for the liquid waste processed through the IWTU. These TAP emission rates are based on a waste feed rate of 3.5 gallons per minute (gpm) under the assumption that 100% of the pollutants that enter the IWTU are emitted through the stack. The combined TAPs were compared to the Idaho emission screening levels. Ambient dispersion modeling has been performed for those TAPs whose emission estimates exceed the emission screening levels. (See Section 5.)

Table 3. Boiler emission estimates.

Pollutant[a]	Emission Factor (lb/10^{12} BTU)	Emission Factor (lb/1000 gal)	Emission Rate (lb/hr)	Emission Rate (lb/yr)
Total Particulate Matter (PM)[b]		2	0.15	1,306
PM_{10}		1.08	0.08	705
Nitrogen Oxides (NO_X)		20	1.49	13,060
Volatile Organic Compounds (VOC)		0.252	0.02	165
Sulfur Oxides (SO_2)		42.6	3.18	27,818
Carbon Monoxide (CO)		5	0.37	3,265
Lead[b]	9		9.39E-05	0.82
Fluorides			0.00	0
Sulfuric Acid Mist			0.00	0
Hydrogen Sulfide			0.00	0
Total Reduced Sulfur			0.00	0
Reduced sulfur compounds			0.00	0

a. Pollutant emission factors derived from AP-42, Chapter 1.3, Fuel Oil Combustion, except SO_2 emissions, which are based on 0.3 percent S fuel as required by DEQ Permit No., P-030505, 1/21/04.

b. Example calculations: PM = (653,013 gal/yr) × (2 lb/1000 gal) = 1,306 lb/yr; PM = (1,306 lb/yr)/(8,760 hr/yr) = 0.15 lb/hr. Lead = (9 lb/10^{12} BTU) × (653,013 gal/yr) × (140,000 BTU/gal) = 0.82 lb/yr; Lead = (0.82 lb/yr)/(8,760 hr/yr) = 9.39E-05 lb/hr.

4.1.2 Step 2. Estimate Potential Emissions from the New IWTU

Potential emission estimates were performed for the IWTU based on the conservative assumption that all SBW and NGLW would be sent to the unit in one year. Emissions are based on a maximum liquid feed totaling 1,236,000 gallons per year. This liquid feed volume includes all the current SBW stored in tanks plus that which may be newly generated as part of continuing INL activities. Uncontrolled emissions from the IWTU are summarized in Table 4.

Table 4. IWTU potential emissions.

Pollutant	Regulated Emission Estimates[a]: Uncontrolled Emissions[b] (tpy)[c]
Carbon Monoxide	1.44
Nitrogen Oxides	31.77
Sulfur Dioxide	5.20
Particulate Matter	0.04
Lead	1.15E-06
Fluorides	0.06

a. Emissions based from EDF-6495, "Mass and Energy Balance For Sodium Bearing Waste Integrated Waste Treatment Unit - Modified to Support Emissions Permitting."
b. "Uncontrolled emissions" refers to unabated emissions.
c. tpy = tons per year.

- A significant emissions increase (as defined in paragraph 40 CFR 52.21(b)(40)), and
- A significant net emissions increase (as defined in paragraphs 40 CFR 52.21(b)(3) and (b)(23)).

Projected annual emissions increases are calculated and compared to specific thresholds, and if the projected emissions are lower than the threshold, no further PSD review is required. Projected emissions from the new IWTU and associated emissions from other affected sources were considered.

The IWTU will emit new regulated pollutants and will cause the existing boilers at the Site to produce steam at an incrementally higher level. Emissions are estimated for the new IWTU, and for the incremental emissions associated with the existing boilers at the Site. No other emissions sources will be affected by IWTU beyond the existing boilers. The boilers were permitted on January 21, 2004, and supply steam to the entire INTEC facility.

In order to determine facility-wide emissions increases, the incremental emissions from the existing boilers are estimated as Step 1. Emissions from the IWTU are estimated as Step 2. The sum of these emissions is then compared against the significant PSD thresholds as Step 3 to determine if further PSD evaluation is necessary.

4.1.1 Step 1. Estimate Incremental Emissions from the Existing Boilers

The IWTU will require steam for both process and building heat from existing boilers at the Site. These boilers, No's. UTI-608, UTI-609, UTI-610, and UTI-611, are housed in Building CPP-606 at INTEC. Each boiler is rated at 36.4 MMBTU/hr, and combusts distillate fuel only. The sulfur content of the distillate oil is limited to 0.3 percent by an enforceable condition, (DEQ Permit No. P-030505, 1/21/04). Steam from each boiler is routed to a common header for distribution to the Site. Steam demand on these boilers has generally decreased due to the removal of processes at the facility and the demolition of buildings. As a result, the steam-generating boilers have ample existing capacity to supply building and process steam to the IWTU without any physical or operational changes. These boilers will continue to operate within current permit limitations and no permit modification is required for these units. However, the IWTU will require these boilers to burn an incremental amount of distillate fuel over their current actual levels. The incremental steam demand on the boilers is based on the design process and building heat requirements of the IWTU. This total steam demand is calculated to be 77,055,588 pounds per year of which 1,563.3 lbs/hour is for building heating steam and 7,233 lbs/hour of steam is required by the IWTU process. The combined total process and building steam demand of 8,796.3 lbs/hour is conservatively estimated to occur 8,760 hours per year. To satisfy this steam demand, an incremental amount of distillate oil will need to be burned. This incremental, additional amount of fuel is 653,013 gallons of distillate oil. Boiler emissions based on this fuel volume were performed and example calculations are shown below in Tables 2 and 3.

Table 2. Boiler operation estimates for proposed incremental, additional fuel.

	Building Heat[a]	Process Heat[b]	Total
Projected Steam Usage (lb/hr)	1,563.3	7,233	8,796.3
Annual Hours of Operation (hr/yr)	8,760	8,760	—
Annual Projected Steam Usage (lb/yr)	13,694,508	63,361,080	77,055,588
Annual Projected Fuel Usage (gal/yr)	116,055	536,958	653,013

a. Building heat peak load is 8,100 lb/hr. Building heat projected steam usage: peak load of (8,100 lb/hr) × (19.3% - factor is normal building peak heat load vs. peak heat load for INL buildings) = 1,563.3 lb/hr. Annual steam usage: (1,563.3 lb/hr) × (8,760 hr/yr) = 13,694,508 lb/yr. Annual fuel usage: (13,694,508 lb/yr)/118 lb/gal = 116,055 gal/yr; conversion factor = 1 gal fuel/118 lbs steam.
b. Process heat peak load is 7,233 lb/hr. Annual process heat steam usage: (7,233 lb/hr) × (8,760 hr/yr) = 63,361,080 lb/yr. Annual fuel usage: (63,361,080 lb/yr)/118 lb/gal = 536,958 gal/yr.

Table 1. Stack information.

Stack Name	Stack ID	Stack Height (m)	Temperature	Exit Velocity (m/s)	Diameter (m)
IWTU Main Stack	STK-SRE-140	36.6	62°C (335K)	17.8	1.51

3. FACILITY CLASSIFICATION

The INL Site is a major source with potential or actual emissions of greater than 250 tons per year of a regulated pollutant, NO_X. The area is classified as attainment for all criteria pollutants. The IWTU facility is subject to major source permitting as applicable under 40 CFR 52, "Prevention of Significant Deterioration" (PSD), and under 40 CFR 70, Title V, air operating permit rules. The INL Site is also a major source of hazardous air pollutants (HAPs) under 40 CFR 63.

4. EMISSIONS ESTIMATES

Emissions from the IWTU are calculated assuming that all SBW and NGLW would be sent to the unit in one year. This maximum amount is 1,236,000 gallons of liquid waste. This liquid volume is the amount of SBW that is currently stored on-Site in tanks, plus an additional amount of waste that could be generated during the tank closure and clean-up activities. The maximum volume of liquid waste is calculated as follows:

883,000 gallons of SBW currently in tanks (which includes SBW currently contained in the tanks plus 5% from jet dilution) + 40% additional waste = 1,236,000 total gallons.

The amount of NGLW is based on a conservative engineering estimate referenced in EDF-6495. Projected emissions for pollutants regulated under 40 CFR 52 were estimated as part of the PSD evaluation and discussed in Section 4.1. Projected emissions for criteria and state toxic air pollutants (TAPs) are discussed, respectively, in Sections 4.2 and 4.3.

Emission estimates for Tables 2 through 6 are based on information contained in EDF-6495.

In addition, radionuclides for the IWTU facility are subject to 40 CFR 61, Subpart H, "National Emission Standards for Emission of Radionuclides other than Radon from Department of Energy Facilities." The effective dose equivalent (EDE) results are above the 0.1 mrem/yr threshold (i.e., 1% of the 10 mrem/yr standard at 40 CFR 61.92 per Appendix D methodology) requiring an Approval To Construct, per 40 CFR 61.96(b). A separate approval to construct application was submitted to EPA Region 10. A copy of this National Emission Standards for Hazardous Air Pollutants (NESHAP) application has been provided to DEQ under separate cover.

4.1 PSD Evaluation

The emissions from the proposed IWTU installation were reviewed for applicability to PSD. A PSD review is required prior to the construction of any major new source, or the modification of any existing, major stationary source in an area designated as attainment or unclassifiable under sections 107(d)(1)(A)(ii) or (iii) of the federal Clean Air Act. The PSD regulations are found at 40 CFR 52.21 and at IDAPA 58.01.01.205.01 of the Idaho Administrative Code. A project is a "major modification" for a regulated pollutant if it causes two types of emissions increases:

than 2 microns in the loop stream. Level detection is provided for the bottom cone of the filter. When the solids reach a predetermined level, the solids are transferred to the Product Receiver Filter Product Pump and then transported to one of the Product Receiver Coolers.

The Product Receiver/Coolers Blower Loop Heat Exchanger uses ventilation air drawn from the Canister Packaging area as a cold stream, and exchanges the heat from the Product Receiver/Coolers to this ventilation flow. The ventilation (cold side) flow then passes through the Building Ventilation HEPA Filters with the rest of the facility's building ventilation streams.

2.2.4 Canister Fill Stations

The Canister Fill Stations are three parallel trains of equipment to fill, cap, and decontaminate canisters for storage of the processed waste. A shielded transfer bell on a dedicated transfer crane with grapple is used to access the canister fill stations and move canisters. Each of the three parallel trains consists of the following: a shielded loading cell with overhead plug to allow the shielded transfer bell to place and remove canisters from the canister loading cell, a Canister Fill Station Transfer Cart and Lift to move the canisters through the filling and capping process, a Canister Sealing Nozzle to prevent leakage to the outside of the canister, and a Canister Decontamination Zone to clean any product spills off the canister. Also included is a vacuum system to draw air and potential product spills away from the canister and into a collection system. Included in the vacuum system are the Product Handling Vacuum Filter, F-SRC-185, and the Product Handling Post Filter, F-SRC-186. These vessels contain sintered-metal filter elements that are designed to remove ≥99.9% of all solids greater than 2 microns. The air from these sintered-metal filters then passes to the Building Ventilation System.

2.2.5 Building Ventilation System

Building ventilation is drawn from areas of lower potential contamination to areas of greater potential contamination before passing through the Building Ventilation HEPA Filters, which are arranged in a fashion similar to the Process HEPA Filters and routed to the Air Mixing Box prior to discharge out the stack.

2.2.6 Air Mixing Box

The Air Mixing Box, MIX-SRE-140, is designed to improve the blending of the process exhaust and building ventilation exhaust streams. The air mixing box provides and maintains the volume needed to contain the air exhausted from the two systems (process and building) and also supplies the greatest level of mixing in the shortest distance. The air mixing box is 9 × 9 × 9 ft and includes dampers, damper actuators, static mixers for each inlet stream, and a mixing section. The air mixing box discharges to the stack.

2.2.7 Stack

The Stack, STK-SRE-140, is constructed of carbon steel. Stack height is approximately 36.6m (120 ft), including the cement base, with a base diameter of approximately 2.5m (8 ft) and a diameter of approximately 1.5m (5 ft) at the discharge point. (See Table 1.)

2.2.8 Monitoring

The stack is equipped with a NO_X monitor and a radioactivity monitor.

Each filter tier includes individual inlet/outlet connections and inlet/outlet bubble-tight dampers, and each consists of a pre-filter, test inlet section, primary HEPA filter element, test combination section, secondary HEPA filter element, and a test outlet section. Each filter tier includes test ports upstream and downstream of each HEPA filter.

High-efficiency particulate air (HEPA) filter systems are designed to meet code as specified in ASME AG-1 (except for its special high temperature pack-to-frame sealant and gasket material which have not been qualified to ASME AG-1, however they are both UL-586 classified), meet specifications of DOE-STD-3020-97, and be tested using the guidelines of ASME N510-1989.

2.2.1 Mercury Adsorbers

Process gas from the Process HEPA Filters flows to the Mercury Adsorbers, F-SRH-141 A/B, although not required for control of State of Idaho Toxic Air Pollutants compliance, sulfur-impregnated granular activated carbon (GAC) beds remove vapor-phase mercury present in the process gas. The adsorber system is designed to operate the adsorbers in series and provide for vertical upflow through two horizontal GAC beds of equal volume. The vessels are ducted with a gas bypass to allow either one of the two beds to be used as the primary bed. No abatement of any radionuclides is credited with this system as it is specifically designed for mercury.

Mercury sample nozzles are provided across each of the carbon beds and also across both combined beds. Mercury detection will be performed manually by obtaining periodic samples and having the samples analyzed at a laboratory facility. Mercury detection between the beds will initiate a change to the bed processing configuration (secondary bed will be switched to primary and primary will be switched to secondary) and will initiate a carbon replacement cycle of the spent bed. The process gas is then routed to the Process Exhaust Blowers.

2.2.2 Process Exhaust and Building Ventilation Exhaust Blowers

The Process Exhaust Blowers provide vacuum pressure to the Process HEPA Filters and the Mercury Adsorbers. Normally, one blower will operate at a time at 100% capacity with an in-line installed spare.

Three Building Ventilation Exhaust Blowers are provided for CPP-1696. To ensure 100% availability, two blowers will be in service and one in standby. These blowers discharge to the Air Mixing Box, MIX-SRH-140.

2.2.3 Product Receiver/Cooler and Cooling Loop

The Product Receiver/Coolers, COL-SRC-170A/B/C, are stainless-steel vessels that receive treatment product and elutriated fines from the DMR and CRR, the Process Gas Filter, and the Offgas Filter. The Product Receiver/Cooler Blower recirculates cooled nitrogen into the Product Receiver/Coolers to cool the treatment product. When the solids cool to a predetermined temperature, the solids are transferred to a RH-72B canister located below each Receiver/Cooler.

The vent gas from the Product Receiver/Coolers flows through a cooling loop to remove the heat from the treatment product. From the Product Receiver/Coolers, the vent gas flows to the Product Receiver Filter, F-SRC-180, then to the Product Receiver/Coolers Blower Loop Heat Exchanger, on to the Product Receiver/Cooler Blower, which drives the flow through the loop, and back to the three Product Receiver/Coolers. The Product Receiver Filter is a stainless-steel vessel containing high-temperature-rated sintered-metal filter elements designed to remove ≥99.9 % of all solids greater

The process gases from the DMR flow through the Process Gas Filter to the fluid gas inlet distributors of the CRR, VES-SRC-160. Oxygen/air is fed into the CRR at multiple locations within the bed. This creates distinct reducing and oxidizing zones in the CRR. In the lower reducing sections, residual NO_X from the DMR is further reduced to nitrogen gas. Organic materials, hydrogen, and carbon monoxide are oxidized and steam reformed in the oxidizing zone (upper portions of the bed and freeboard) of the CRR to produce carbon dioxide and water.

The average normal operating temperature of the CRR is maintained between 775°C and 1150°C.

The CRR fluidized-bed media is a semi-permanent fluidized bed comprised of granular alumina. Since essentially all solids are removed from the DMR process gases before input as fluidizing gas in the CRR, the only increase in bed solids in the CRR is from planned additions of alumina bed media from the additive feeder system. It is expected that no CRR bed material will be drained during normal operation for the duration of the SBW treatment campaign, however, in the event that CRR bed media must be removed, the CRR is equipped with an auger/grinder assembly similar to the DMR. Solids removed from the CRR are pneumatically transferred to the Product Receiver/Coolers.

2.1.7 Offgas Cooler

The Offgas Cooler, COL-SRC-160, is a vertically suspended vessel located adjacent to the CRR that is designed to cool the treated offgas from the CRR to below 200°C. The cooling of the offgas is achieved by direct water cooling of the offgas vapor with a nitrogen-atomized water spray. All of the water is evaporated and is carried with the cooled offgas as water vapor to the Offgas Filter.

2.1.8 Offgas Filter

The Offgas Filter is comprised of sintered-metal filter elements provided to capture primarily carbon fines carried over from the CRR in the now cooled process gas in order to reduce loading and improve the service life of the downstream emissions control equipment (i.e., Process HEPA Filters and Mercury Adsorbers). The filter and piping are insulated to maintain temperature in the offgas system. The sintered metal filters are designed to remove ≥99.5% of particles greater than 2 microns in size. Collected filter solids are pneumatically transferred using nitrogen to the Product Receiver/Coolers where the fines are combined with the granular solids removed from the bottom of the DMR.

2.1.9 Offgas Blowers

Offgas Blowers provide vacuum for the Process Gas Filter, CRR, and Offgas Filter. One blower will operate and the other will act as an installed spare. These blowers are equipped with a single speed motor designed to generate a suction pressure of approximately -65-in. water column at 7,500 actual cubic feet per minute (acfm).

2.2 Process Exhaust System

The Process Exhaust System includes the Process HEPA Filters, the Mercury Adsorbers, and the Process Exhaust Blowers. Although not required for control of State of Idaho Toxic Air Pollutants, the Process HEPA Filters are located upstream of the Mercury Adsorbers and are provided to filter out any trace radioactive particulate components in the offgas. The Process HEPA Filter system consists of filter tiers that provide a total of approximately 10,000 acfm filtration capacity. All offgas piping and the Process HEPA Filters are insulated to maintain temperature in the offgas system above 120°C.

Carbon is added to the DMR at regular intervals via a hopper and air-lock at the top of the vessel. The carbon provides a heat source to maintain bed temperature and reacts with the superheated steam to provide chemical reactants that promote reduction of nitrogen oxides (NO_X) to nitrogen.

The waste is fed into the DMR through three injectors above the fluidizing gas (oxygen enriched steam) distributor. The waste feed is atomized into the vessel using nitrogen and/or instrument air, and is instantly evaporated and superheated to the bed temperature by the large mass of hot, fluidized treatment product solids. The resulting dried waste solids quickly heat to reaction temperatures. The small amount of organics in the feed are volatized, pyrolyzed, and steam reformed upon contact with the hot bed solids.

During start-up, the bed consists of alumina-based or carbonate-based bed media. However, during operations, this material is quickly replaced by carbonate-based, inert treatment product, so that within approximately 4 to 5 days of standard operation, the original bed media is substantially converted to treatment product solids. The DMR generally operates with an average bed temperature of 525°C to 700°C when producing a carbonate-rich treatment product.

A set of three cyclone separation devices internal to the upper head of the DMR serves to separate larger particles entrained in the gas, returning the captured particles to the bed via gravity drain through downcomer pipes and allowing the process gas to flow from the DMR to the Process Gas Filter.

A portion of the DMR bed solids are removed from the bottom of the DMR as necessary through an auger/grinder assembly and transferred to the Product Receiver/Coolers and Canister Packaging systems. The DMR Product Classifier removes large particles of unspent carbon from the treatment product and returns them to the DMR fluidized bed.

2.1.5 Process Gas Filter

The process gas from the DMR flows to the Process Gas Filter, F-SRC-153. The Process Gas Filter is comprised of sintered-metal filter elements, provided to capture any DMR product fines carried over in the process gas. The Process Gas Filter operates at approximately 50° to 100°C below the DMR temperature. The sintered-metal filters are designed to remove ≥99.5 % of particles greater than 2 microns in size. The purpose of the Process Gas Filter is to collect elutriated carbonate fines from the DMR, which could form agglomerations in the much warmer CRR fluidized bed. Collected filter solids are periodically pneumatically transferred using nitrogen to the Product Receiver/Coolers where the fines are combined with the granular solids removed from the bottom of the DMR.

2.1.6 Carbon Reduction Reformer

The second treatment vessel, the CRR, is a vertical, cylindrical, carbon-steel vessel that is entirely refractory-lined. The refractory throughout the system is composed of high-alumina/chrome oxide. The CRR is fluidized by the process gases from the DMR. Purified carbon is added to the reformer, which reacts with the oxygen/air in the system to heat the unit and provide further chemical reactions for the process. A stainless-steel, insulated shroud that is offset from the outer surface of the CRR surrounds most of the vessel. The purpose of the shroud is to channel cooling air flow around the CRR outer shell to limit heat losses to the building. The CRR interior wall temperature is thereby regulated to prevent gases from condensing at the internal vessel walls. The piping between the CRR and Offgas Cooler is also refractory lined and encased within a shroud. Thermocouples monitor the external temperature of the vessel and/or piping and regulate the air flow through the shroud by adjusting damper positions that control the flow of air through the shroud and into the building ventilation system.

2.1.2 IWTU Operations

The IWTU treats mixed liquid wastes, both SBW and the NGLW resulting from normal operations and facility deactivation and decommissioning activities. The mixed liquid wastes on the INL Site consist of radioactive, aqueous solutions with high concentrations of nitric acid, nitrates, alkali metals, aluminum, and a wide variety of other inorganic oxides. The SBW steam reforming process: (1) converts nitric acid, nitrates, and nitrites to nitrogen gas; (2) converts organic material in the SBW to carbon dioxide and water vapor; and (3) converts the radionuclides, sodium, potassium, sulfate, chlorides, fluorides, and non-volatile heavy metals into a dry, solid carbonate treatment product.

2.1.3 SBW Feed System

The IWTU Feed System includes waste transfer equipment located in the New Waste Calcining Facility (NWCF), CPP-659, located at INTEC, and waste feed equipment in the IWTU.

SBW to be treated in the IWTU is transferred from the INTEC TFF to either of three NWCF Blend and Hold Tanks, VES-NCC-101, VES-NCC-102, or VES-NCC-103. The waste is adjusted, blended, and/or sampled, as necessary, in the NWCF before being pumped to the IWTU for treatment. The SBW is sent to the IWTU through a remote transfer operation controlled by IWTU personnel. Two of the three NWCF tanks, VES-NCC-102 and VES-NCC-103, are equipped with waste transfer pumps, which feed a common waste transfer pipe for transfer of SBW to the Waste Feed Tank, VES-SRC-131.

The Waste Feed Tank is provided with a stainless-steel feed pump, which pumps SBW to the Denitration and Mineralization Reformer (DMR) for processing, and also provides tank recirculation. The pump recirculates the waste feed to keep the anticipated fine heel solids in the SBW fully suspended in solution. A small slip stream is drawn off the recirculation flow for processing during reformer operation.

The waste from the tank is pumped by the waste feed pump into the DMR through three waste feed injectors. Three flow control valves control the waste feed to the nitrogen cooled injectors at 0.5 to 1.75 gpm each, with a combined not-to-exceed total feed rate limit of 3.5 gpm. This maximum feed rate flow is assured by an automatic waste feed cutoff programmed into the Distributed Control System. The waste enters the waste feed injectors and is atomized into the DMR with a controlled flow of compressed nitrogen and/or instrument air.

2.1.4 Denitration and Mineralization Reformer

The DMR and a second reformer, the Carbon Reduction Reformer (CRR) are the core of the IWTU processing system. In these two units, the waste feed is combined with co-reactants and low-pressure superheated steam in a fluidized bed. The DMR volatilizes trace organic materials; nitric acid, nitrates, and nitrites are converted to nitrogen gas; and inorganic constituents in the waste are converted to a dry, solid carbonate product.

The DMR, VES-SRC-140, is a vertical, cylindrical vessel constructed of appropriate high temperature-resistant metal alloy. The DMR contains a steam and carbon-heated fluidized bed that operates in an oxygen-starved or reducing atmosphere to treat SBW and NGLW.

Low-pressure, superheated steam enriched with controlled quantities of nitrogen/oxygen is injected into the bottom of the DMR through fluidizing gas distributors spaced evenly through the diameter of the vessel, providing the motive force for the bed.

IWTU SBW Process Description

Approximately 900,000 gallons of mixed liquid waste, containing both hazardous and radioactive components, are stored in three - 300,000 gallon tanks at the INTEC TFF. This waste is collectively known as SBW. A steam reforming process has been proposed to treat this waste. The specific steam reforming technology proposed is a dual fluidized bed process that uses superheated steam, carbon, and other additives to convert the SBW into a solid granular treatment product that is packaged into canisters suitable for ultimate disposal. The process is named the IWTU because two fluidized bed steam reformers are integrated into a single treatment process with a common air pollution control system.

The steam reforming process proposed for the IWTU consists of two steam reformers that are integrated into a single process system (Figure 4).

IWTU Operations

The IWTU treats mixed liquid wastes; both SBW and newly generated liquid waste (NGLW) resulting from normal operations and facility deactivation and decommissioning activities. The mixed liquid wastes at the INL consist of radioactive, aqueous solutions with high concentrations of nitric acid, nitrates, alkali metals, aluminum, and a wide variety of other inorganic oxides. The SBW steam reforming process: 1) converts nitric acid, nitrates, and nitrites to nitrogen gas; 2) converts organic material in the SBW to carbon dioxide and water vapor; 3) converts the radionuclides, sodium, potassium, sulfate, chlorides, fluorides, and non-volatile heavy metals into a dry, solid carbonate waste product.

SBW Feed System

The IWTU Feed System includes waste transfer equipment located in the New Waste Calcining Facility (NWCF), CPP-659, located at INTEC and waste feed equipment in the IWTU.

SBW to be treated in the IWTU is transferred from the INTEC TFF to either of three NWCF Blend and Hold Tanks, VES-NCC-101, VES-NCC-102, or VES-NCC-103. The waste is adjusted, blended, and/or sampled, as necessary, in the NWCF before being pumped to the IWTU for treatment. The SBW is sent to the IWTU through a remote transfer operation controlled by IWTU personnel in concert with NWCF personnel. Two of the three NWCF Hold Tanks, VES-NCC-102 and VES-NCC-103, are equipped with waste transfer pumps, which feed a common waste transfer pipe for transfer of SBW to the Waste Feed Tank, VES-SRC-131.

The Waste Feed Tank is provided with a stainless steel in-tank feed pump, which pumps SBW to the Denitration and Mineralization Reformer (DMR) for processing and also provides tank recirculation. The pump recirculates the waste feed to keep the anticipated fine heel solids in the SBW fully suspended in solution. A small slip stream is continuously drawn off the recirculation flow for processing during reformer operation.

The waste from the tank is pumped by the waste feed pump into the DMR through three waste feed injectors. Three flow control valves control the waste feed to the nitrogen cooled injectors at 0.5 to 1.75 gpm each, with a combined not-to-exceed total feed rate limit of 3.5 gpm. This maximum feed rate flow is assured by an automatic waste feed cutoff programmed into the

Distributed Control System. The waste enters the waste feed injectors and is atomized into the DMR with a controlled flow of compressed nitrogen and/or instrument air.

Denitration and Mineralization Reformer (DMR)

The DMR and a second reformer, the Carbon Reduction Reformer (CRR), are the core of the IWTU processing system. In these two units, the waste feed is combined with co-reactants and low pressure superheated steam in a fluidized bed. The DMR volatilizes trace organic materials; nitric acid, nitrates, and nitrites are converted to nitrogen gas; and inorganic constituents in the waste are converted to a dry, solid carbonate product.

The DMR, VES-SRC-140, is a vertical cylindrical vessel constructed of appropriate high temperature resistant metal alloy. The DMR contains a steam and carbon-heated fluidized bed that operates in an oxygen-starved or reducing atmosphere to treat SBW and NGLW. The DMR is operated under reducing conditions.

Low-pressure superheated steam enriched with controlled quantities of nitrogen/oxygen is injected into the bottom of the DMR through four fluidizing gas distributors spaced evenly through the diameter of the vessel, providing the motive force for the bed.

Carbon is added to the DMR at regular intervals via a hopper and air-lock at the top of the vessel. The carbon provides a heat source to maintain bed temperature and reacts with the superheated steam to provide chemical reactants that promote reduction of nitrogen oxides (NOx) to nitrogen.

The waste is fed into the DMR through three injectors above the fluidizing gas (oxygen enriched steam) distributor. The waste feed is atomized into the vessel using nitrogen and/or instrument air, and is instantly evaporated and superheated to the bed temperature by the large mass of hot, fluidized treatment product solids. The resulting dried waste solids quickly heat to reaction temperatures. The organics in the feed are volatized, pyrolyzed, and steam reformed upon contact with the hot bed solids.

During start-up, the bed consists of alumina-based or carbonate-based bed media. However, during operations, this material is quickly replaced by carbonate-based inert treatment product, so that within approximately 4 to 5 days of standard operation, the original bed media is substantially converted to treatment product solids. The DMR generally operates with an average bed temperature of 600°-700°C when producing a carbonate-rich treatment product.

A set of three cyclone separation devices internal to the upper head of the DMR serves to separate larger particles entrained in the gas, returning the captured particles to the bed via gravity drain through downcomer pipes and allowing the process gas to flow from the DMR to the Process Gas Filter.

A portion of the DMR bed solids are removed from the bottom of the DMR as necessary through an auger/grinder assembly and transferred to the Product Receiver/Coolers and Canister Packaging systems. The DMR Product Classifier, CYC-SRC-141, removes large particles of unspent carbon from the treatment product and returns them to the DMR fluidized bed.

Exhaust gases are then routed to an off-gas treatment system consisting of two high efficiency particulate air (HEPA) filters, and a sulfur-impregnated granular activated carbon (SGAC) mercury adsorber, and vented to the atmosphere through a dedicated stack. The mineralized product from the DMR and sintered metal filter is removed, cooled, and pneumatically transferred to a solid product packaging station. At the packaging station, the product is loaded into remote-handled disposal canisters.

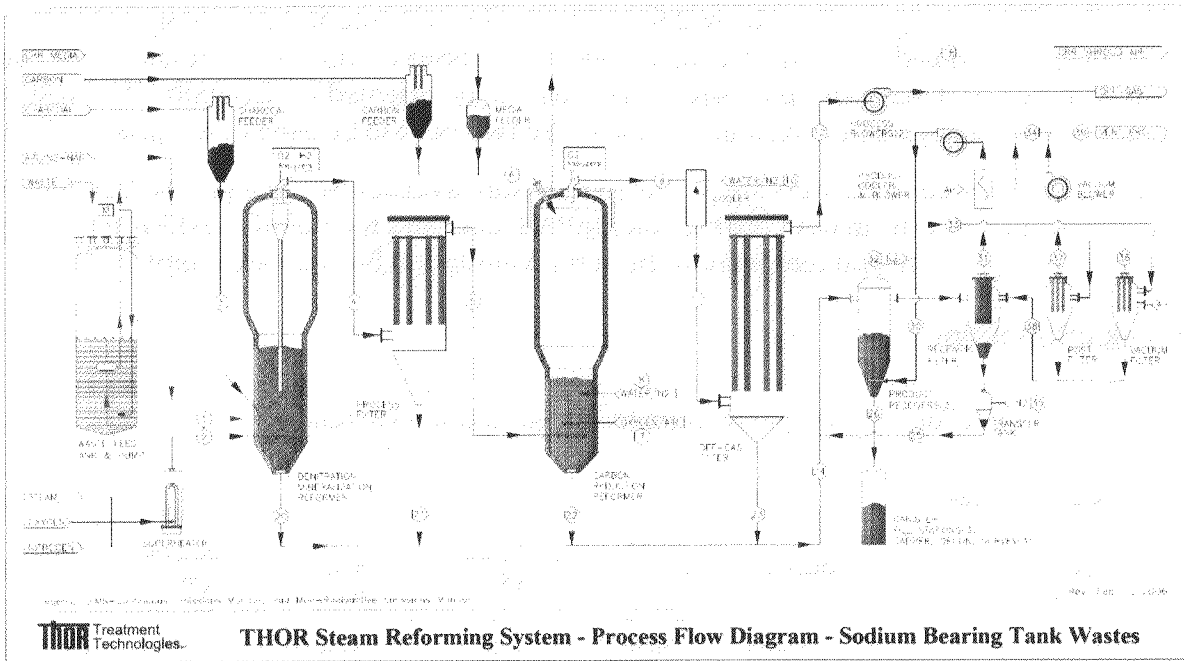

FIGURE 4.
SIMPLIFIED PROCESS FLOW DIAGRAM OF SBW TREATMENT IN THE IWTU

Emissions

Source Information

The sodium bearing waste steam reforming system off-gasses are cooled by a water cooler and quench scrubber, and then fines removed in a process filter. The process off-gas stream then flows through a HEPA Filter and a Mercury Adsorber. Ventilation air from the modules and facility buildings pass through HEPA Filters and is combined with the process off-gas for discharge through a common monitored stack to the atmosphere. A continuous emissions monitor system (CEMS) will be provided for monitoring nitrogen oxides and radionuclides.

The process off-gas flow from the outlet of the process blower is directed to the final HEPA Filters designed to reduce emissions prior to discharge to the atmosphere. Filter housing (banks) are provided with a normal operating flow of approximately 2,000 actual cubic feet per minute each. Filter housings may be installed in parallel, with the gas flow split equally between the filters.

The vault modules and building ventilation flows from the IWTU and the Waste Product Transfer off-gas are combined and filtered by the Building HEPA Filters to reduce emissions prior to discharge to the atmosphere. Filter housings are provided, with a normal operating flow of approximately 2,000 actual cubic feet per minute each. Filter housings may be installed in parallel, and the gas flow split equally between the filters. HEPA filter systems are designed to meet code as specified in ASME AG-1, meet specifications of DOE-STD-3020-97 and be tested using the guidelines of ASME N510-1989.

Mercury Adsorbers utilize sulfur impregnated granular activated carbon (SGAC) beds to remove vapor phase mercury present in the process gas. The adsorber system is designed for vertical upflow through two horizontal SGAC beds of equal volume (20 ft. long x 10 ft. wide x 42 in. deep). Each bed is designed to meet mercury emissions limits, individually. The beds are located in two 10 ft. diameter pressure vessels, which are oriented horizontally. The vessels are ducted with a gas bypass to allow either one of the two beds to be used as the primary bed.

Redundant Ventilation Blowers are provided to ensure availability. The on-line Ventilation Blower pulls suction from both the Process HEPA Filters and the Building HEPA filters. Both the discharge pressure and temperature from the Ventilation Blowers are monitored.

Stack Information

Table 1 identifies future stack parameters for Integrated the IWTU.

Table 1.0 Stack Parameters

Stack Name	Stack ID	Stack Height (m)	Temperature (K)	Exit Velocity (m/s)	Diameter (m)
IWTU Main Stack	STK-SRH-140	36.6	335	17.8	1.51

Estimated Emissions

A preliminary review of Prevention of Significant Deterioration (PSD) applicability for the proposed treatment of SBW for the IWTU installation was performed. Results of the PSD emission summary are presented in Table 2.

TABLE 2.0 PSD EMISSION SUMMARY
IWTU PTC Application Regulated Emission Estimates

Pollutant	Projected Emissions from Existing Boilers Uncontrolled[1] (ton/yr)	IWTU Potential Controlled[2] Emissions (ton/yr)	Total Regulated Emissions (ton/yr)	Significant Emission Rate (ton/yr)	Significant Emission Rate Exceeded ?
Total Particulate Matter (PM)	6.53E-01	3.37E-09	0.65	25	No
PM10	3.53E-01	3.37E-09	0.35	15	No
Nitrogen Oxides (NOX)	6.53	31.77	38.30	40	No
Volatile Organic Compounds (VOC)	8.23E-02	0.00	0.08	40	No
Sulfur Oxides (SO2)	13.91	5.20	19.11	40	No
Carbon Monoxide (CO)	1.63	1.44	3.07	100	No
Lead	4.11E-04	1.04E-13	0.0004	0.6	No
Fluorides	0.0	0.06	0.06	3.0	No

Notes:
[1] Projected Emissions from Existing Boilers are the incremental increase of uncontrolled emissions from the boilers that will provide steam to the IWTU.
[2] IWTU Potential are controlled emissions resulting from the total liquid waste to be treated (also presented in Table 3 of this document).

The PSD review resulted in no significant threshold exceedances; therefore, no further PSD evaluation is required.

The CPP-606 distillate fueled boilers will be able to supply all the required amount of steam necessary to support the IWTU facility without triggering a modification to the existing PTC, No. P-030505, Building CPP-606 distillate oil-fired boilers, issued January 21, 2004. INL shall continue to monitor and record the amount of boiler fuel combusted from the boilers and operate within the established parameters in PTC, P-030505. In addition, a boiler TAP analysis has been previously performed in the development of PTC, P-030505, Building CPP-606 distillate oil-fired boilers, issued by DEQ on January 21, 2004. Therefore, no further TAP analysis is required for the CPP-606 boilers. This protocol will only evaluate emissions associated with the IWTU.

The major components in the IWTU offgas will include non-hazardous compounds (nitrogen, water vapor, carbon dioxide, and oxygen). The potential uncontrolled emission rates as established in Table 3.0 (IWTU Liquid Waste Potential Regulated Emissions) are the project specific emissions being evaluated in accordance with PTC procedures and requirements per DAPA 58.01.01.01.200.

TABLE 3.0 IWTU PTC APPLICATION
Regulated Emission Estimates[1]

Pollutant	Potential Uncontrolled Emissions[2] (ton/yr)	Potential Controlled Emissions[3] (ton/yr)
Carbon Monoxide	1.44	1.44
Nitrogen Oxides	31.77	31.77
Sulfur Dioxide	5.20	5.20
Particulate Matter	0.04	3.37E-09
Lead	1.15E-06	1.04E-13
Fluorides	0.06	0.06

Notes:
[1] Emissions based from *EDF, "Mass and Energy Balance For Sodium Bearing Waste Integrated Waste Treatment Unit - Modified to Support Emissions Permitting" Table 2, CH2M<>WG Idaho, LLC, 11/14/2005.*
[2] Uncontrolled refers to unabated emissions
[3] Controlled refers to abated emissions

State Toxic Air Pollutants

INL has conservatively estimated toxic air pollutants (TAPs) based on no emission controls (unabated emissions). INL has performed unabated (no emission controls) and abated (emissions control equipment) pilot testing to simulate the treatment of INL SBW. Although pilot testing has shown that many of the TAPS are further reduced with the addition of emissions control equipment, such as HEPA filters and a mercury GAC adsorber, the abated toxic emission results are not included as part of this PTC application. INL is not taking credit for treating any toxics with emissions control equipment to illustrate that even under worse case conditions toxic emissions are below IDAPA screening levels or acceptable ambient concentrations for carcinogens and non-carcinogen pollutants.

Table 4 summarizes the potential TAP emission rates for the liquid waste processed through the IWTU. These TAP emission rates are based on a waste feed rate of 3.5 gallons per minute (gpm) under the assumption that 100% of the pollutants that enter the IWTU are emitted through the stack. The combined TAPs were compared to the Idaho emission screening levels. Ambient dispersion modeling will be performed for those TAPs whose emission estimates exceed the emission screening levels.

TABLE 4.0 SUMMARY OF IWTU POTENTIAL TOXIC AIR POLLUTANTS

IWTU PTC Application Liquid Waste Toxic Air Pollutants[1]

Pollutant	Potential Uncontrolled Emission Rate[2] (lb/hr)	IDAPA 58.01.01.585/586 Emission Level (lb/hr)	Potential Toxic Emission Rate vs. EL
Silver (Ag)	7.76E-04	1.00E-03	Below
Aluminum (Al)	3.31E+01	6.67E-01	**Exceeds**
Arsenic (As)	3.16E-04	1.50E-06	**Exceeds**
Barium(Ba)	1.95E-02	3.30E-02	Below
Beryllium (Be)	2.02E-04	2.80E-05	**Exceeds**
Bromine (Br_2)	6.10E-05	4.70E-02	Below
Calcium Oxide (CaO)[3]	6.82E+00	1.33E-01	**Exceeds**
Cadmium (Cd)	5.04E-01	3.70E-06	**Exceeds**
Chloride (Cl_2)[4]	2.05E+00	2.00E-01	**Exceeds**
Chromium III (Cr)	5.06E-01	0.33E-01	**Exceeds**
Fluoride (F)[5]	1.19E+00	6.67E-01	**Exceeds**
Hydrochloric Acid (HCl)	2.11E+00	5.00E-02	**Exceeds**
Mercury (Hg)	3.23E+00	7.00E-03	**Exceeds**
Molybdenum (Mo)	4.81E-02	6.67E-01	Below
Nickel (Ni)	2.02E-01	2.70E-05	**Exceeds**
Rhodium (Rh)	9.28E-04	6.70E-02	Below
Selenium (Se)	1.58E-04	1.30E-02	Below
Tin (Sn)	1.05E-02	1.33E-01	Below
Zinc (Zn)	1.16E-01	6.67E-01	Below

Notes:

[1] Toxic Metal Air Pollutants based from *EDF, "Mass and Energy Balance For Sodium Bearing Waste Integrated Waste Treatment Unit-Modified to Support Emissions Permitting," Table 3, CH2M•WG Idaho, LLC, 11/14/2005.*

[2] Uncontrolled emission rate refers to unabated emissions.

[3] All calcium expected in the off-gas was assumed as CaO.

[4] All chlorine in the emissions assumed as Cl_2.

[5] Fluoride is a regulated pollutant, potential pound per hour total evaluated.

Dispersion Model

Air modeling will be performed to evaluate the atmospheric dispersion of contaminants from the IWTU stack to downwind locations at which members of the public could potentially be exposed to emissions from the facility. The EPA-approved ISC-Prime (Version 04269) air dispersion model is proposed. This is consistent with approved modeling currently being done at the site for a RCRA risk assessment. The Building Profile Input Program for PRIME (BPIPPRM version 04274) will be used to assess potential building downwash of the IWTU stack. The modeling will be conducted using a 1 g/second release of a generic particulate contaminant. Model output for maximum air concentrations (g/m3 per g/second released) will then be multiplied by contaminant-specific release rates (g/second) to obtain contaminant-specific results.

Standards and Criteria Levels

Table 5.0 summarizes applicable criteria including:

- The Significant Contribution Levels (SCL)
- The National Ambient Air Quality Standards (NAAQS)

Modeling will be conducted to determine if the emission rates will result in an impact greater than the applicable Idaho significant contribution levels (SCL) shown in Table 5.0. If the predicted impacts are not significant (that is, less than the SCL), the modeling is complete for that pollutant under that averaging time. If impacts are significant, a more refined analysis will be conducted for demonstration of compliance with the NAAQS. A description of the modeling methodology is presented below.

TABLE 5.0 NATIONAL AMBIENT AIR QUALITY STANDARDS.

Pollutant	Averaging Period	Significant Contribution Levels (μg/m3)	NAAQs Standard (μg/m3)
CO	1-hour	2000	40000 [a]
	8-hour	500	10000 [a]
SO_2	3-hour	25	1300 [a]
	24-hour	5	365 [a]
	Annual	1	80 [a]
NO_2	Annual	1	100 [a]
PM_{10}	Annual	1	50 [a]
	24-hour	5	150 [a]

[a]National Ambient Air Quality Standards (NAAQS), IDAPA 58.01.01.

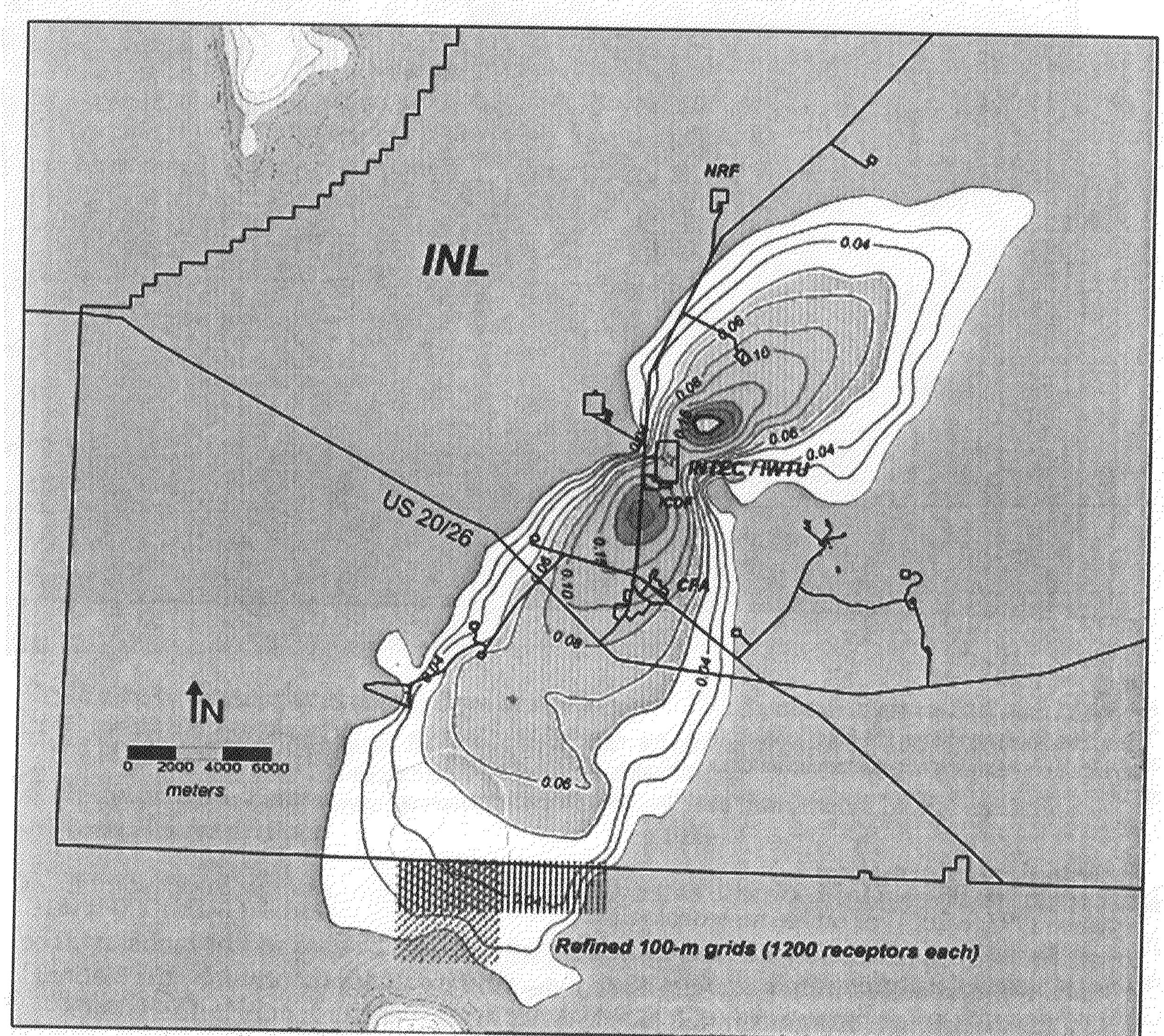

FIGURE 6.
"INL" site boundary grids. Two refined (100-m spacing) receptor grids at the INL site boundary and Big Southern Butte area will be used for evaluating maximum off-site impacts. Note that this Figure shows only the example grid spacing. The isopleths are from modeling runs performed for other purposes, and are not representative of emissions from the IWTU.

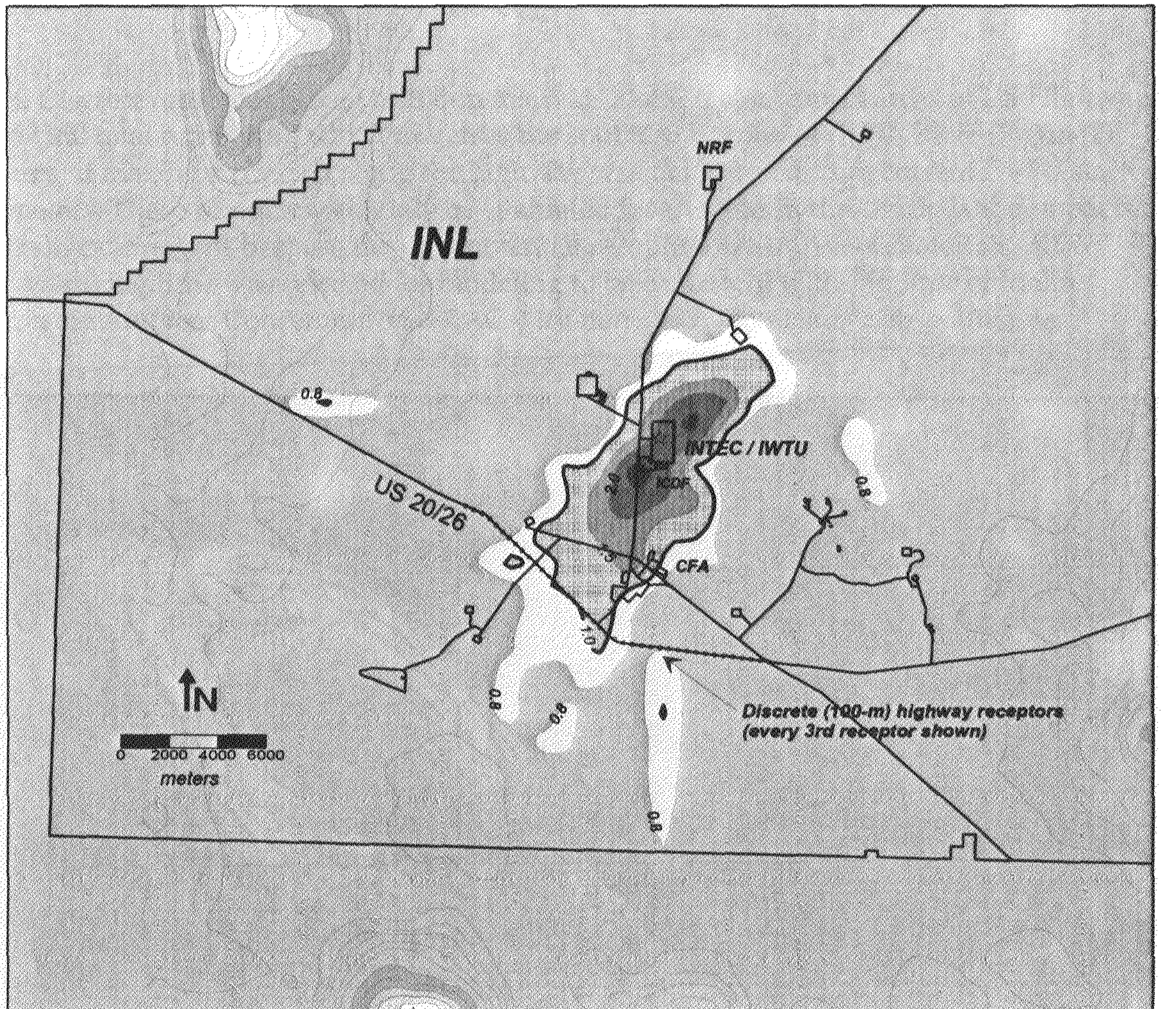

FIGURE 7.
"HWY" grid. Discrete (100-m interval) receptors along the major impact area on US Highway 20/26 (dotted line) used for evaluating maximum short-term (24-hour) inhalation impacts. Note that this Figure shows only the proposed grid spacing. The isopleths are from modeling runs performed for other purposes, and are not representative of emissions from the IWTU.

Meteorological Information

Five years (1997 to 2001) of onsite meteorological (ME) data from the Grid 3 (GRD3) 200-ft (61-m) tower, located approximately 1.5 km north of the INTEC, will be used for the modeling. The Grid 3 data were processed into sequential hourly ISC-Prime data input format by the National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory in Idaho Falls, Idaho.

The NOAA determined stability classes using the lateral turbulence (σA) and wind speed method as outlined in the EPA report Onsite Meteorological Program Guidance for Regulatory Modeling Applications (EPA 1987). The small amount of missing data in the NOAA files was filled using hourly data (for the same month, day, and hour) from other INL site towers (e.g., the CFA) or, for single hour gaps, linear interpolation. Wind speeds less than the anemometer's

ISC-Prime will be run with the following options.

Control Options Input

The following control pathway modeling options (CO) were selected.

- Regulatory default job control and dispersion options (EPA 1995)
  - Final plume rise, stack-tip downwash
  - Buoyancy-induced dispersion
  - Calms processing routine
  - No use of missing data processing routine
  - Default wind profile exponents
  - Default vertical potential temperature gradients
  - Upper bound values for supersquat buildings
  - No exponential decay for RURAL mode
- RURAL dispersion coefficients (sigmas)
- Annual averaging time for chronic and carcinogenic compounds
- 24-hour averaging times for acute compounds
- Terrain heights evaluated [taken from the INL Geographical Information System (GIS) database]. These elevations were developed from the U.S. Geological Survey National Elevation Data (NED).

Receptor Information

The following three receptor (RE) grids will be evaluated for each particulate and vapor model run:

- **BIG:** Initial modeling runs were made using a 1 kilometer (km) coarse receptor grid which covered a major portion of the INL and surrounding terrain including the Big Southern Butte area located 5-km south of the INL site boundary [approximately 38-km (E-W) x 34-km (N-S)] (Figure 5).

- **INL Site**: A refined (100-m spacing) grid was placed in the area of maximum impact which occurred on the southern INL site boundary (not Big Southern Butte). This refined grid consisted of 17 rows of 35 receptors at 100-m intervals which start at the INL boundary and extend south for 1600-m in order to determine that the maximum concentration was fully resolved.

- **HWY:** Discrete receptors placed at 100-m intervals along major impact areas of US Highway 20/26 (160 total receptors), which traverses the southern portion of the INL site (Figure 7). The area of maximum impact along the highway was determined from current IWTU stack parameters. These receptors will only be evaluated for short-term direct inhalation impacts from non-carcinogens because the only potential receptors are transient motorists. A 24-hour averaging time was selected for modeling to be consistent with the State of Idaho Acceptable Ambient Concentrations (AACs) for non-carcinogenic toxic air pollutants.

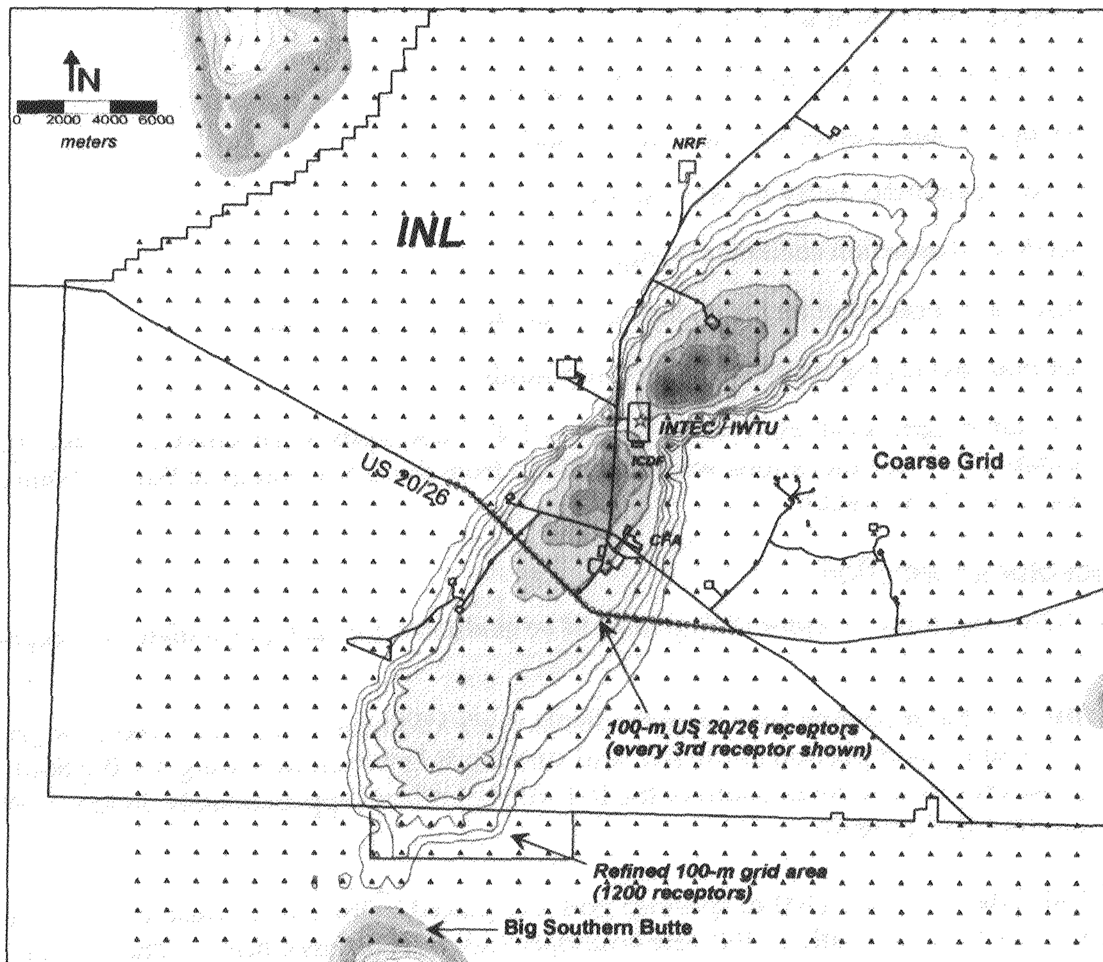

FIGURE 5. "BIG" grid – a 38 km (E-W) x 34 km (N-S), 1 km-spacing coarse receptor grid used for evaluating general dispersion trends, determining maximum on-site concentrations and deposition, and determining the location of refined off-site grids. Annual-average air concentration isopleths for the IWTU stack are shown.

starting threshold (0.26 m/second) were set to 0.0 for calms processing in ISC-Prime. Wind speeds between the anemometer starting threshold and 1.0 m/second were set to 1.0 m/second to ensure that the model does not calculate unrealistic concentration estimates (EPA 1995a; EPA 1996). Since the INL does not collect upper air (lid height) data, a 150-m height was assumed for the annual-average modeling runs based on the direction of the Idaho DEQ. This is extremely conservative as the NOAA Air Resources Laboratory at the INL has previously determined these heights to be approximately 800-m (annual average) and 100-m (short-term), reference: Jerry Saggendorf memo to Mike Abbott, NOAA letter dated February 11, 1991. Lower mixing heights are more conservative because they constrain the maximum vertical dispersion that can occur.

Ambient Conditions

Background air quality data recommended for modeling analyses was provided via e-mail by Darrin Mehr of DEQ on May 8, 2006. Table 6.0 provides a summary of these background concentrations.

TABLE 6.0
Background Criteria Pollutant Concentrations ($\mu g/m^3$)

Pollutant	1-hr	3-hr	8-hr	24-hr	Quarter	Annual
NO_x	NA	NA	NA	NA	NA	4.3
SO_2	NA	34	NA	26	NA	8
PM_{10}	NA	NA	NA	42	NA	9.6
CO	3,600	NA	2,300	NA	NA	NA
Lead	NA	NA	NA	NA	0.03	NA
Ozone	NA	NA	NA	NA	NA	0.0070[a]

Preliminary Analysis

The preliminary analysis for each pollutant will be conducted as follows.

- If the predicted impacts are not significant (that is, less than the SCL), the modeling is complete for that pollutant under that averaging time.
- If impacts are significant, a more refined analysis, as described below, will be conducted.
- For NO_x, it will be initially assumed that all NO_x is converted to NO_2. If the resulting concentration exceeds the SCL, then the concentration will be multiplied by the default annual NO_2/NO_x ratio of 0.75 as suggested by EPA and compared to the SCL again. If the resulting concentrations still exceed the SCL, then a refined analysis will be conducted.
- Toxic pollutant impacts will be compared to the acceptable ambient concentrations for non-carcinogens or carcinogens, as applicable.

Refined Analyses – Criteria Pollutants

Comparison to the Ambient Air Quality Standards

- For pollutants with concentrations greater than the SCLs, the maximum concentration will be determined and compared to the NAAQS. This maximum concentration will include contributions from the facility, nearby sources, and ambient background concentrations. Background concentrations from Table 6 will be used to determine concentrations.
- DEQ will be contacted to identify nearby sources, if any, that need to be included in the analysis.

Output – Presentation of Results

The results of the air dispersion modeling analyses will be presented as follows.

- A description of modeling methodologies and input data
- A summary of the results in tabular and, where appropriate, graphical form
- Modeling files used for the ISC-Prime analysis will be provided with the application on compact disk
- Any deviations from the methodology proposed in this protocol will be presented.

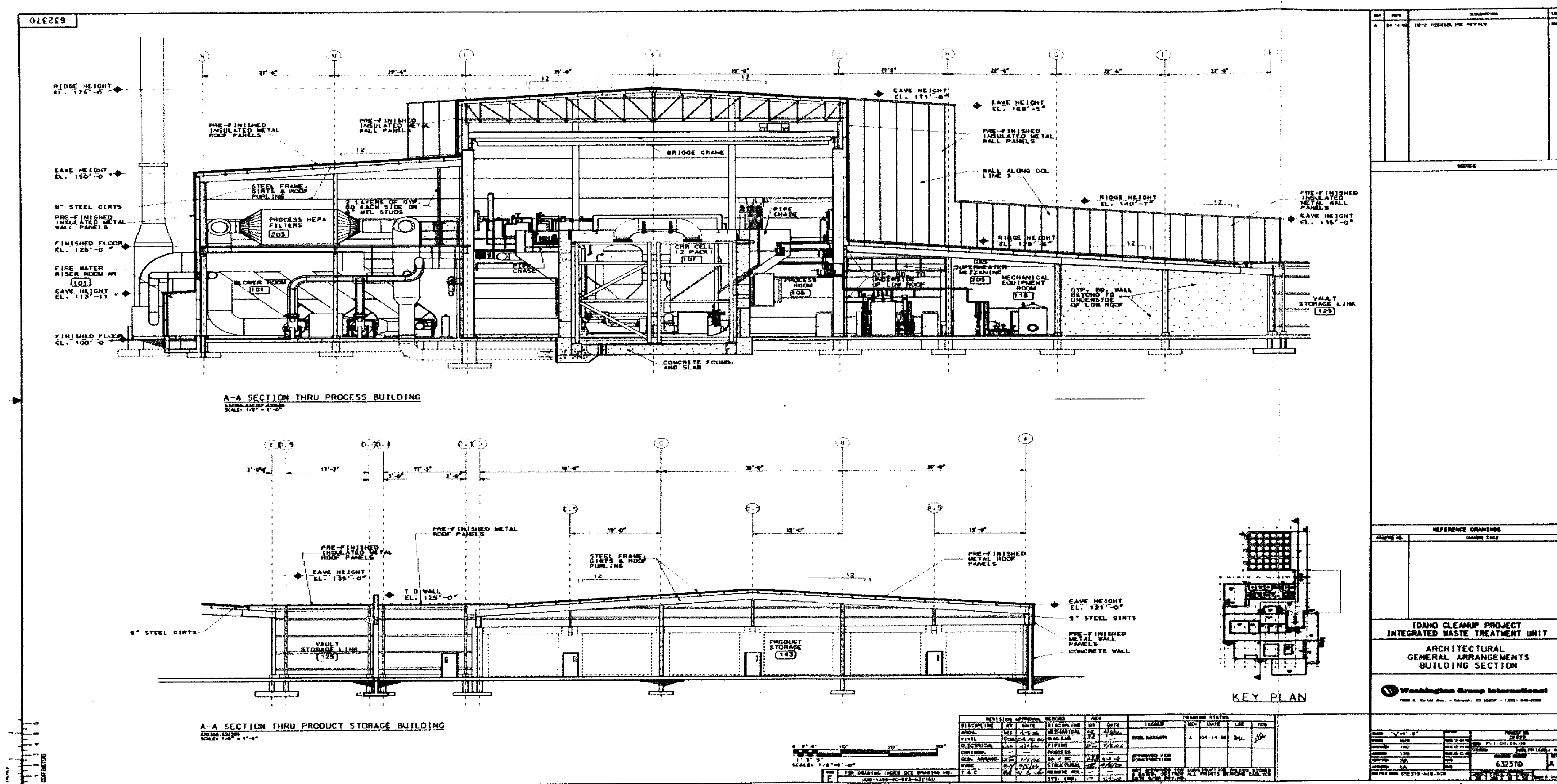

FIGURE 3.
PROCESS BUILDING AND PRODUCT STORAGE BUILDING SECTIONS IN THE IWTU FACILITY.